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Van Sangyan

Note to Authors:

We welcome the readers of Van Sangyan to write to us about their views and issues in forestry. Those who wish to share their knowledge and experiences can send them:

by e-mail to vansangyan_tfri@icfre.org

or, through post to The Editor, Van Sangyan,
Tropical Forest Research Institute,
PO-RFRC, Mandla Road,
Jabalpur (M.P.) - 482021.

The articles can be in English, Hindi, Marathi, Chhattisgarhi and Oriya, and should contain the writers name, designation and full postal address, including e-mail id and contact number.

TFRI, Jabalpur houses experts from all fields of forestry who would be happy to answer reader's queries on various scientific issues. Your queries may be sent to The Editor, and the expert's reply to the same will be published in the next issue of Van Sangyan.

Cover Photo: Panoramic view of Achanakmar-Amarkantak Biosphere Reserve
Photo credit: Dr. N. Roychoudhury and Dr. Rajesh Kumar Mishra, TFRI, Jabalpur (M.P.)

From the Editor's desk

Tropical forests are disappearing at an alarming rate of 13.5 million hectare per year globally. In India about 20% of the geographical area is under forest in which tropical forests contribute nearly 83% of the forest area. Almost half of the forest area is classified as degraded forest with poor population density and species abundance. Deforestation and forest degradation are widely recognized as major threats to environmental stability, economic prosperity and social welfare and also to perform the statutory function of biodiversity conservation and ecosystem services. Often the forest management considers primarily commercially important monoculture species and rehabilitation of site for ecosystem/landscape management/species conservation or societal services assumes secondary importance. When the degraded and desolated lands do not turn out an economic yield, many sites are abandoned where natural succession proceeds and over a period of time several biotic communities colonize there and perform a variety of ecosystem function

Despite a growing awareness that the herbaceous layer serves a special role in maintaining the structure and function of forests, this stratum remains an underappreciated aspect of forest ecosystems. Because species diversity is highest in the herb layer among all forest strata, forest biodiversity is largely a function of the herb-layer community. Competitive interactions within the herb layer can determine the initial success of plants occupying higher strata, including the regeneration of dominant overstory tree species. Furthermore, the herb layer and the overstory can become linked through parallel responses to similar environmental gradients. These relationships between strata vary both spatially and temporally. Because the herb layer responds sensitively to disturbance across broad spatial and temporal scales, its dynamics can provide important information regarding the site characteristics of forests, including patterns of past land-use practices. Thus, the herb layer has a significance that belies its diminutive stature.

This issue of Van Sangyan contains an article on Analysis and extend of trees outside forest. There are also useful articles, such as Community conservation of forest genetic resources through sacred groves in Namakkal district, Tamil Nadu, Sphaeranthus indicus: an ethanobotanical plant from the forest of Andhra Pradesh, Neem as a biopesticide and medicine, Diversity of macro-fungi in central India-IV: Auricularia auricula-judae, a neutraceutical jelly mushroom, Major causes leading to the destruction of Sierra Leone forest estate, Chemical insecticides and their hazardous impact, World Network of Biosphere Reserves, उन्नत रोपणी एवं उपकरण, घास है मगर खास है (in Hindi) and Biodiversity of Oriolus oriolus and Melia azedarach.

I hope that readers would find all information in this issue relevant and valuable. Van Sangyan welcomes articles, views and queries on various issues in the field of forest science.

Looking forward to meet you all through forthcoming issues.

Dr. N. Roychoudhury
Scientist G & Chief Editor

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Analysis and extend of trees outside forest

B. Singh, D.K. Yadav and M.K Jhariya
Department of Farm Forestry, Sarguja University
Ambikapur-497001 (C.G.)

Abstract
The tree outside forest (TOF) was evaluated in the Ambikapur town (Sarguja) of northern Chhattisgarh. Well planned survey was conducted in different localities of north and South aspect of the town to record maximum representatives of the species. The result revealed that across the sites a sum of 44 species distributing into 23 families were recorded. The Leguminaceae family was found to be dominant. In different sites wide variations were recorded in terms of number of species, family, occurance and distribution of species in different locality concerned. Among the different sites, site-I reflects higher diversity of the TOF resources (25 species with 18 families). The lowest species was recorded in site-V (13) while the least family diversity was found in site-IV (9). The richness of TOF followed the order as site-I > site-II > site-III > site-IV > site-VI > site-V, respectively. There is great variation in the TOF in different location. These resources needs to be protected and managed well so that its optimum level of population can be achieved which further facilitate the urban development in sustainable manner besides its environmental and ecological functions and outputs.

Keywords: Diversity, ecological function, tree outside forest, tree resources

Introduction

Trees outside forests (TOF) play crucial roles in ecosystem services, national economies and mitigating the effect of climate change. TOF are significantly important since they perform a number of ecological, economical and socio cultural functions. These functions are production, protective and service functions. In the developing country like India, the growing population leads to an increasing demand for land, wood and other NTFPs resulting in depletion and degradation of forest resources. Since the forest resources rapidly decrease, the role of TOF is becoming more important. More recently, importance of TOF has gained more attention due to its substantial role in carbon sequestration, biodiversity conservation, anti-desertification and poverty alleviation (Nair, 2011).

TOF are the trees found on lands not defined as “Forest” and “Other Wooded Land” as per FAO definitions and includes small woodlots, tree rows, scattered trees, road side, occurring in non-forest setting as urban, rural or agroforestry systems. TOF are often, but not always, planted or domesticated trees and they include trees in cities, on farms, along roads and in many other locations that are not a part of a forest (FAO, 2000). TOF represent a widespread and diverse resource therefore, they are frequently domesticated, cultivated or tended and facilitate various environmental services and products.

However, a lot of work has been done for specific sectors or geographic location, often with emphasis on their economic values. Information of the size, distribution and location of trees becomes a critical step in urban planning, development and managment. Thus, the reliable information

on TOF presence, distribution, extend, type and quality is needed, particularly in the larger areas where forest cover is very less (FAO, 2005). The challenge for a better evaluation of trees and their services is to improve our understanding of the status and dynamics of all tree resources including TOF (FAO, 2001). Scince the concept of TOF is relatively new, studies and researches carried out in this respect are insufficient to enhance the concept of management of this resource. Therefore, an attempt has been made to analyse the extend of TOF in Ambikapur town of Chhattisgarh.

Material and methods

The present work is carried out in Ambikapur town of Sarguja district in Chhattisgarh. Chhattisgarh has nearly 41.18% forest area to the total geographical area (FSI, 2011). Among the different district (27 districts), Sarguja is blessed with very rich biological diversity (Sinha *et al.*, 2014 & 2015; Yadav *et al.*, 2015; Jhariya and Yadav, 2016). It lies between 22^0 58' to 23^0 49' N latitude and 81^0 33' to 82^0 45' E longitude. Average elevation of the area varied between 600 meter and more. The climate of district is characterized by hot summer and well distributed rainfall during the monsoon season. The mean monthly temperature ranges between 15.34^0C (January) and 31.54^0C (May) and the mean annual temperature averages 23.31^0C. The average annual rainfall is 1161.42 mm (Sinha *et al.*, 2015).

The sites were selected in two directions (North- South) to compile Tree outside forests (TOF) in urban environment of Sarguja. Field studies were conducted in a planned manner repeatedly in different localities in order to document maximum representation of tree species. During the repeated field visits, the observations on field characters such as habit, habitat, spread, etc., were made. Almost the entire area was surveyed in order to know the vegetation in the study area. In each of these areas all the tree species encountered were identified by their natural habitats and the data was collected in the prescribed proforma.

Results and discussion

Status and extend of TOF

The study revealed that there are diverse tree species present in various localities of the concerned sites. It found that some locality of the study region have maximum occurance of TOF while some regions are poor to very poor in vegetation distribution. Across the sites a sum of 44 species representing 23 families were recorded (Table 1). The Leguminaceae family was found to be dominant while Bixaceae, Bombaceae, Dipterocarpaceae, Lamiaceae, Moringaceae, Musaceae, Poaceae, Punicaceae, Rhamnaceae, Santalaceae, Sapindaceae, Sapotaceae and Verbenaceae were represented by single species (Figure 1).

In site-I total 29 species belonging to 18 families were recorded. The most dominant family was Leguminaceae comprising 5 tree species. It was found that maximum numbers of trees were found along the road side (Table 2). *Azardica indica* was found maximum in number and present in all the locality followed by *Dalbergia sissoo*, *Ficus religiosa*, *Mangifera indica*, *Psidium guajava* and *Saraca indica*. The members of family Melieceae, Leguminaceae, Anacardiaceae, Moraceae and Myrtaceae were found abundantly.

A sum of 25 species distributied into 16

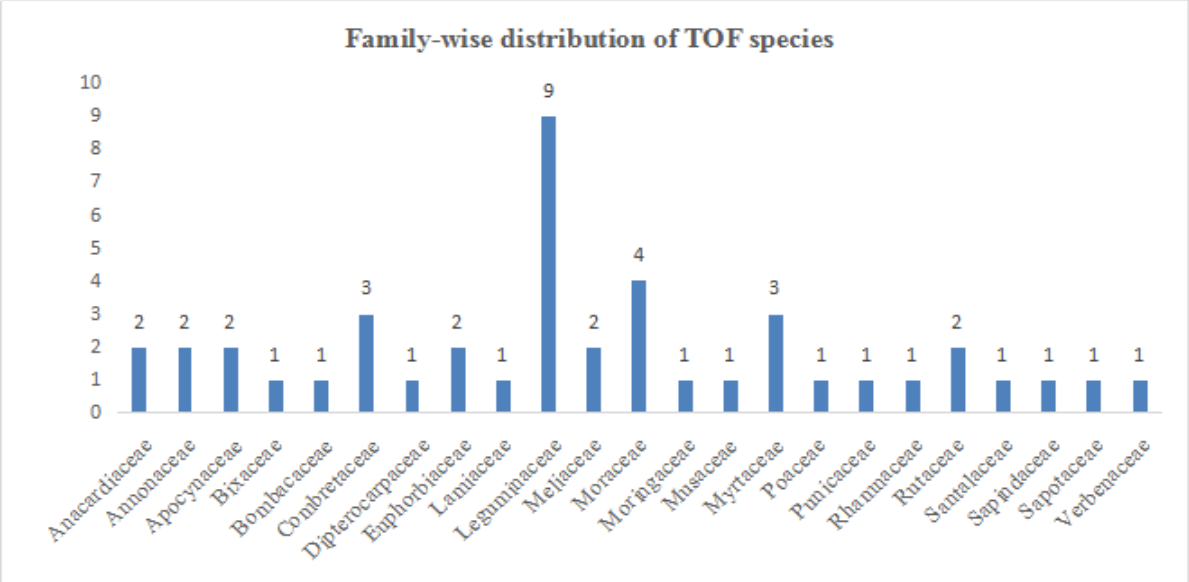

Figure 1: Distribution of TOF in the study region

families were recorded in site-II. The family Leguminaceae was found dominant which comprises 7 species of TOF. It was found that maximum numbers of trees were found along the road side followed by private land locality (Table 3). *Alstonia scholaris* was found maximum in number followed by *Shorea robusta*, *Eucalyptus globulus*, *Mangifera indica* and *Ziziphus mauritiana*.

The site-III comprises of 23 species distributed among 18 families were recorded. The most dominant family was Leguminaceae. It was found that maximum numbers of trees were found along the road side followed by private land and homestead locality. *Aegle marmelos* was found maximum in number followed by *Moringa oleifera* and *Ziziphus mauritiana*.

Site-IV representing a sum of 17 species which were distributed into 9 families. It was found that maximum numbers of trees were found along the road side followed by home stead and near pond locality. *Mangifera indica* was found maximum in number and most occured species in the different localities. Species like *Emblica officinalis*, *Ficus benghalensis*, *Madhuca indica*, *Pongamia pinnata* and *Punica granatum* were found to be rare in this site.

Total of 13 species belonging to 11 families were recorded in site-V. It was found that maximum numbers of trees were found along the road side followed by home stead and private land. *Saraca indica* was found maximum in number and distributed almost all the locality in this site. The species such as *Bixa orellana*, *Punica granatum* and *Syzygium cumini* were found rare in occurance in this site.

In site-VI a sum of 15 species belonging to 10 families were recorded. It was found that maximum numbers of trees were found in private lands followe by road site and home stead locality of the concerned study site. *Aegle marmelos* was found maximum in number followed by *Nerium indicum*.

There are substantial tree species recorded in various localities of the Ambikapur town. Most of them are widely occurred along the road side, home stead and private land localities. This findings was

Table 1: List of Tree outside forests (TOF) found in study sites of Sarguja

Species	Family
Acacia nilotica	Leguminaceae
Aegle marmelos	Rutaceae
Albizia spp.	Leguminaceae
Alstonia scholaris	Apocynaceae
Anacardium occidentale	Anacardiaceae
Annona squamosa	Annonaceae
Artocarpus hetrophyllus	Moraceae
Azadirachta indica	Meliaceae
Bambusa bamboos	Poaceae
Bauhinia spp	Leguminaceae
Bixa orellana	Bixaceae
Bombax ceiba	Bombacaceae
Butea monosparma	Leguminaceae
Cassia siamea	Leguminaceae
Citrus limonia	Rutaceae
Dalbergia sissoo	Leguminaceae
Emblica officinalis	Euphorbiaceae
Eucalyptus globulus	Myrtaceae
Ficus benghalensis	Moraceae
Ficus religiosa	Moraceae
Gmelina arborea	Verbenaceae
Jatropha carcus	Euphorbiaceae
Litchi chinensis	Sapindaceae
Madhuca indica	Sapotaceae
Mangifera indica	Anacardiaceae
Melia azedarach	Meliaceae
Moringa oleifera	Moringaceae
Morus alba	Moraceae
Musa paradisiaca	Musaceae
Nerium indicum	Apocynaceae
Polyalthia longifolia	Annonaceae
Pongamia pinnata	Leguminaceae
Psidium guajava	Myrtaceae
Punica granatum	Punicaceae
Santalum album	Santalaceae
Saraca indica	Leguminaceae
Shorea robusta	Dipterocarpaceae
Syzygium cumini	Myrtaceae
Tamarindus indica	Leguminaceae
Tectona grandis	Lamiaceae

Terminalia arjuna	Combretaceae
Terminalia bellerica	Combretaceae
Terminalia chebula	Combretaceae
Ziziphus mauritiana	Rhamnaceae

Table 2: Status of TOF in Site-I of Sarguja

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica		√						
Aegle marmelos		√		√				
Anacardium occidentale	√						√	
Annona squamosa	√						√	
Azadirachta indica	√	√	√	√	√	√	√	√
Bixa orellana			√				√	√
Gmelina arborea				√			√	
Citrus limonia		√		√				
Dalbergia sissoo	√	√		√	√		√	
Emblica officinalis	√			√	√			√
Ficus benghalensis		√			√		√	√
Ficus religiosa		√			√	√	√	√
Jatropha carcus					√			
Litchi chinensis	√						√	
Madhuca indica		√					√	√
Mangifera indica	√	√		√			√	√
Moringa oleifera	√	√						
Nerium indicum							√	√
Pongamia pinnata		√				√		√
Psidium guajava	√	√		√			√	√
Punica granatum	√							
Saraca indica	√	√	√	√			√	
Shorea robusta							√	√
Syzygium cumini	√	√						
Tamarindus indica		√					√	
Terminalia arjuna		√						
Terminalia bellerica		√						
Terminalia chebula		√						
Ziziphus mauritiana		√				√	√	

Table 3: Status of TOF in Site-II of Sarguja

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica		√		√			√	√

Aegle marmelos	√	√			√		√	√
Albizia spp.		√					√	√
Alstonia scholaris	√	√	√	√	√	√	√	√
Annona squamosa	√	√	√				√	
Azadirachta indica	√	√			√		√	√
Bauhinia spp	√	√					√	
Bixa orellana	√	√	√					√
Bombax ceiba		√					√	√
Butea monosparma		√					√	√
Cassia siamea		√					√	
Eucalyptus globulus		√		√	√	√	√	√
Madhuca indica		√			√		√	√
Mangifera indica	√	√		√	√		√	√
Melia azedarach		√					√	
Moringa oleifera	√	√					√	
Morus alba	√							√
Musa paradisiaca	√					√	√	
Polyalthia longifolia		√						
Pongamia pinnata		√		√			√	√
Shorea robusta	√	√	√	√	√		√	√
Tamarindus indica		√					√	
Terminalia arjuna		√		√			√	
Terminalia bellerica	√	√					√	
Ziziphus mauritiana	√	√		√	√		√	√

Table 4: Status of TOF in Site-III of Sarguja

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica		√						
Aegle marmelos	√	√		√	√	√	√	√
Bambusa bamboos		√			√		√	√
Bixa orellana		√	√					
Citrus limonia	√	√						
Emblica officinalis	√	√					√	
Ficus benghalensis		√						
Ficus religiosa		√		√		√	√	
Gmelina arborea	√		√				√	
Litchi chinensis	√	√						
Madhuca indica	√						√	
Mangifera indica	√					√	√	
Moringa oleifera	√	√		√	√		√	√
Pongamia pinnata	√			√				
Punica granatum	√	√			√		√	

Santalum album	√			√				
Saraca indica							√	
Shorea robusta		√		√			√	√
Syzygium cumini		√		√			√	√
Tectona grandis		√		√			√	
Terminalia arjuna	√	√	√			√		
Terminalia bellerica		√		√			√	
Ziziphus mauritiana	√	√		√	√		√	√

Table 5: Status of TOF in Site-IV of Sarguja

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica		√			√		√	√
Aegle marmelos	√	√		√	√	√	√	√
Anacardium occidentale	√				√		√	
Annona squamosa	√	√			√		√	
Artocarpus hetrophyllus	√	√		√	√		√	
Citrus limonia	√	√		√	√		√	
Dalbergia sissoo	√	√			√		√	√
Emblica officinalis		√						
Ficus benghalensis		√						
Ficus religiosa		√					√	
Madhuca indica		√						
Mangifera indica	√	√		√	√	√	√	√
Pongamia pinnata		√						
Punica granatum	√							
Saraca indica	√	√	√	√	√			
Shorea robusta		√			√			
Tamarindus indica	√	√						

Table 6: Status of TOF in Site-V of Sarguja

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Aegle marmelos	√	√			√			
Alstonia scholaris	√	√	√		√			
Annona squamosa	√				√		√	
Bixa orellana			√					
Dalbergia sissoo		√					√	
Gmelina arborea	√			√			√	
Moringa oleifera		√					√	
Nerium indicum	√	√	√					
Punica granatum			√					
Saraca indica	√	√	√	√	√	√	√	√
Syzygium cumini		√						

Tectona grandis		√					√	
Ziziphus mauritiana	√	√					√	

Table 7: Status of TOF in Site-VI of Sarguja

Species	Home Stead	Road side	B/W Road	Institution	Near Pond	Drain line	Private Land	Others
Acacia nilotica		√					√	
Aegle marmelos	√	√		√	√	√	√	√
Anacardium occidentale		√						√
Annona squamosa			√					
Artocarpus hetrophyllus	√						√	
Bixa orellana		√	√					
Citrus limonia	√							
Emblica officinalis	√	√						
Ficus benghalensis							√	
Ficus religiosa							√	
Litchi chinensis	√						√	
Madhuca indica	√	√						
Mangifera indica		√					√	
Nerium indicum	√	√	√		√		√	
Pongamia pinnata							√	

well supported by Pandey (2008), who reported that most TOF available under the proection and management which falls in private property regimes. A high value of TOF was reported by Dias (2003). He found a sum of 84 species of tree outside forest during his study in Ghana. Kweyu (2009) reported 50 tree species as TOF for Kenya which found to be very closer to our estimated values.

Conclusion

A wide variation was recorded in the extent and distribution of the TOF in the town area. It revealed that road site, home stead and private land locality have the much of the total recorded species of TOF. The distribution of TOF in the Ambikapur town is generally affected by urbanization, social development and change in land-use. TOF among the few options are available to over come the problem of ever growing demand for forest products and the shrinking of the available forest resources. The sustained production from the forest can be achieved through proper management implication and extending the TOF area are favourable suggestions that would effectively function as major solution for demand and supply problem of forests based products.

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Community conservation of forest genetic resources through sacred groves in Namakkal district, Tamil Nadu

R. Deepak Kumar and S. Suresh Ramanan
Department of Forest Management and Utilization, College of Forestry,
Kerala Agricultural University, Thrissur, Kerala – 680656.

Worshiping nature is an ancient tradition in India and all forms of life are considered as sacred. Sacred groves are remaining patches ofnatural forest untouched and preserved by ancient dwellers on religious, spiritual and cultural traditions. These sacred groves were locally known as KannimarKovil or KoilKaadu or Nandavana. Patches of natural vegetation are demarked during hunting-gathering phase of human civilisations, often equated to deity and folklore for the conservation (Ramesh and Muthuchelian, 2012). These were restricted sites about secret of organisms and their uses by forefathers which are numerous uses. Sacred groves are serving as the repository of endemic, rare and threatened species, medicinal plants, wild relatives, giant trees and various life forms in the regions (Ganesan et al., 2007). These were refugia to numerous amounts of insects, reptiles, birds and mammals. It is also serves as the watershed of the surroundings where rivers and streams are originated. Sacred groves are usually surrounded with Agricultural landscapes or degraded forest ranges. Conservation of biodiversity through indigenous religious beliefs, mythological stories and taboos by the local communities.These are one of the classic example of people`s initiatives for in-situ conservation of native biodiversity. The deity in the sacred groves is represented by a stone or iron bill hook kept under the robust tree or in the open space without any shelter. It is believed that any attempt to build the temple for deity is would attract the punishment. There are number of taboos, and religious faith existed in the communities are aim to preserving pristine condition. Some of trees are considered as sacred trees which are remained untouched. Some of the trees areAal (*Ficus benghalensis*), Puli (*Tamarindus Indica*), Panai (*Borassus flabelifer*), Vembu (*Azadirachta indica*), Kal-icthi (*Ficus mollis*), Aarasu (*Ficus religiosa*), Maa (*Mangifera indica*), Illupai (*Madhuca longifolia*) in Namakkal district. These Sacred groves are reservoir of wild relatives such as Kattukarunaikzhilangu (*Amorphophallus sylvaticus*),

Threats to sacred groves of Namakkal

- Weakening of religious beliefs and taboos among local peoples leads to increase pressure on natural forest.
- Increasing human population and land use changes leads to destruction of sacred groves.
- There are factors like building big temples inside sacred groves, making infrastructures, uncontrolled crowd during festive seasons, use of modern crackers and campfire leads to degradation of groves.
- Disturbances leads to invasion alien weeds like *Lantana Camara, Leucaena leucocephala, Parthenium hysterophorus, Chromolaena*

odorata, *Prosopis Juliflora* into the sacred groves.

Strategies for conserving sacred groves

- Need to create awareness among the local communities about importance of sacred groves.
- Need to do extensive research and documenting the vital information in the People biodiversity registers.
- Non-governmental organisations, forest department, Hindu endowment department, research and educational institutions should come forward to create awareness, capacity building of local communities, undertake research and financial supports to conserve the sacred groves.
- Mobilise and group formation among the local communities to conserve and maintaining the sacred groves.Also need to network the sacred groves in the districts.
- Encourage the local communities and temple authorities to come forward to conserve and sustainable management of sacred groves.
- Need to create alternative employment to dependent communities.
- Need to create policy on sacred groves, networking the various sacred groves.

Taboos and believes associated with sacred groves of Namakkal district

- Felling of trees and hunting of animals in sacred groves are prohibited.
- Only after removing upper cloths (Males) and bathing are allowed to enter.
- Peoples should remove the footwear and caps (Traditional also) before entering.
- Mostly males are allowed to enter. But women are periods of menstrual, giving child birth and puberty are not allowed.
- Wild animals should not hunt from groves.
- Any disturbance of groves cause, loss of agricultural crops, illness/death of livestock or offender or offender`s family.
- Slaughter the animals away from the main deity.
- People who are immediate after funeral ceremonies are not allowed to enter.

Sphaeranthus Indicus Linn: An ethanobotanical plant from the forest of Andhra Pradesh

M. Deepa, D. Meera and G.R.S. Reddy
Institute of Forest Biodiversity
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Dullapally, Hyderabad-500 100

Taxonomic classification

- Kingdom: *Plantae*
- Subkingdom: *Viridaeplantae*
- Phyllum: *Tracheophyta*
- Subphyllum: *Euphyllophytina*
- Infraphyllum: *Radiatopses*
- Class: *Magnoliopsida*
- Subclass: *Asteridae*
- Superorder: *Asteranae*
- Order: *Asterales*
- Family: *Asteraceae*
- Genus: *Sphaeranthus*
- Species: *indicus*

Parts used

Whole plant, seeds, flowers and roots.

Introduction

Sphaeranthus indicus Linn. (Asteraceae) is widely used in *Ayurvedic* system of medicine to treat vitiated conditions of epilepsy, mental illness, hemicrania, jaundice, hepatopathy, diabetes, leprosy, fever, pectoralgia, cough, gastropathy, hernia, hemorrhoids, and helminthiasis, dyspepsia and skin diseases. There are reports providing scientific evidences for hypotensive, anxiolytic, neuroleptic, hypolipidemic, immunomodulatory, antio-xidant, anti-inflammatory, broncho-dialatory, antihyperglycemic and hepatoprotective activities of this plant. A wide range of phytochemical constituents have been isolated from this plant including sesquiterpene lactones, eudesmenolides, flavanoids and essential oil. A comprehensive account of the morphology, phytochemical constituents, ethnobotanical uses and pharmacological activities reported are included in this review for exploring the immense medicinal potential of this plant.

Herbal medicines have been used by the mankind since time immermorial. *Ayurveda*, the oldest traditional system of India, reveals that ancient Indians had a rich knowledge of medicinal value of different plants. India has been endowed with a very rich flora owing to the extreme variations in climate and geographical conditions prevalent in the country. With the advent in science, many of the crude drugs used in traditional system have been investigated scientifically. *Sphaeranthus indicus* Linn. is a medicinal plant widely used in Indian traditional system of medicine for curing various ailments. It grows in rice fields, dry waste places and cultivated lands in tropical parts of India. It is distributed throughout India, Sri

Lanka, Africa and Australia from sea level to 1200 m altitude.

Microscopic characters

Leaf

The leaf is dorsiventral and shows abundant trichomes of varying types on both the epidermis. Simple trichomes are three to four celled, thick walled and measure 130.8–145.2 µm in length and 29.0–43.5 µm in width. Trichomes are straight/knee shaped, with a swollen base and with collapsed cell at the middle or at the apex. Midrib shows three to four collateral vascular bundles associated with a group of sclerenchymatous cells on either side.

Stem

The stem shows cork with two to three layers of parenchymatous cells covered with papillose cuticle having trichomes and can be distinguished by the presence of a discontinuous ring of lignified pericyclic fibers and a well-developed ring of bicollateral vascular bundle surrounding the pith. Medullary rays are pitted, lignified and about unitetraseriate.

Root

The root shows on its outer side metaderm, a typical brown colored tissue. It consists of suberized cells, arranged irregularly and forms a protective layer. Radial groups of pericyclic fibers and few stone cells are seen alternating with radially arranged secretory canals in the secondary cortex. Phloem is parenchymatous and radially arranged. Medullary rays are pitted, lignified and about two to five seriate.

***Ayurvedic* preparations**

Mundi churna, mundi panchang swarasa, mundi kavatha.

Photochemistry

A sesquiterpene lactone, and a sesquiterpene acid, 2-hydroxycostic acid, along with the known compounds, β-eudesmol and ilicic acid, have been isolated from the acetone extract of *S. indicus*. Three and two sesquiterpenoids, cryptomeridiol and 4-epicryptomeridiol, have been isolated from this plant. A bicyclic sesquiterpene lactone has been isolated from petroleum ether extract of aerial parts of *S. indicus*. Some other sesquiterpene lactones have also been reported to have been isolated from this plant. Isolation and characterization of sterol glycoside has also been reported. A flavanoid has been isolated from the aerial part of *S. indicus*. The plant is reported to contain deep cherry colored essential oil having methyl chavicol, and alkaloid. Carbohydrates like arabinose, Carbohydrates such as arabinose, galactose, glucose, fructose, lactose, maltose, raffinose and rhamnose have been reported from leaves of *S. indicus*. A novel isoflavone glycoside has also been isolated from leaves. Eudesmenolide type of sesquiterpene glycoside, sphaeranthanolide, with immunostimulant potential has been isolated from the flowers of *S. indicus*. Eudesmenolides such as frullanolide and two sphaeranthus peptide alkaloids have been isolated from flowers. The alcoholic extract of powdered caputula contains stigmasterol and β-sitosterol. A flavone glycoside, 6-tetramethoxy-flavone 7-O-β-d-(1-4)-diglucoside, has been isolated from the stem of *S. indicus.*

Ethnobotonical claims

All the parts of the *S. indicus* have medicinal uses. In *Ayurvedic* system of medicine, the whole herb is used in insanity, tuberculous glands, indigestion, bronchitis, spleen diseases, elephantiasis, anaemia, pain in the uterus and vagina,

piles, biliousness, epileptic convulsions, asthma, leukoderma, dysentery, vomiting, urinary discharges, pain in the rectum, looseness of the breasts, hemicrania. The whole herb is used in *Ayurvedic* preparations to treat epilepsy and mental disorders. Leaves dried in the shade and powdered are used in doses of 20 grains twice a day in chronic skin diseases as an antisyphilitic and a nervine tonic. Hot water extract of the herb is used as an anthelminitic, as a diuretic, as a fish poison and as an aphrodisiac. Flowers are tonic, cooling, alterative and used in conjunctivitis and give strength to weak eyes. The oil prepared using the plant root is reportedly useful in treating scrofula and as an aphrodisiac. The external application of a paste of this herb is beneficial in treating pruritus and edema, arthritis, filariasis, gout and cervical adenopathy. Pulverized seeds have antimicrobial property. It is also stuffed into holes of crabs to kill them. Aqueous extract is poisonous to American cockroaches. In unani, the herb is used as a tonic, laxative, emmenagogue, and also it increases the appetite, enriches the blood, lessens inflammation, cools the brain and gives luster to the eye, is good for sore eyes, jaundice, scalding of urine, gleet, biliousness, boils, scabies, ringworm in the waist, diseases of the chest. The plant is traditionally used for diarrhoea. The entire plant is used as an emmenogogue. Hot water extract of the entire plant is used for glandular swelling of the neck and for jaundice.

Pharmacological activity

Anxiolytic activity

Petroleum ether, alcohol and water extracts (10, 30 and 100 mg/kg, p.o.) from the flowers of *S. indicus* were evaluated for anxiolytic activity, using elevated plus maze, open field test and foot-shock induced aggression test. Petroleum ether extract (10 mg/kg), alcoholic extract (10 mg/kg) and water extract (30 mg/kg) of *S. indicus* flowers produced prominent anxiolytic activity in mice. The study showed an increase in the time spent, percent entries and total entries in the open arm of the elevated plus maze; increased ambulation, activity at center and total locomotion in the open field test and decreased fighting bouts in the foot-shock induced aggression test suggesting anxiolytic activity. Another study also reported the anxiolytic activity of hydroalcoholic extract of whole herb of *S. indicus* (100 mg/kg, p.o.) in the elevated plus maze test and open field test.

Neuroleptic activity

Neuroleptic activity of petroleum ether, alcohol and water extracts of flowers of *S. indicus* (30, 100 and 300 mg/kg, i.p.) were evaluated using apomorphine induced cage climbing and catalepsy in mice model. Only the petroleum ether extract (300 mg/kg, i.p.) reduced total time spent in apomorphine induced cage climbing. Aqueous (300 mg/kg, i.p.) and alcoholic (300 mg/kg, i.p.) extracts showed catalepsy while petroleum ether extract was devoid of it. Neuroleptic activity of hydroalcoholic extract of whole plant of *S. indicus* has also been reported. Hydroalcoholic extract of whole herb of *S. indicus* (100, 200 and 500 mg/kg, p.o.) produced catalepsy, potentiated haloperidol-induced catalepsy and antagonized apomorphine-induced stereotypy.

Sedative effect

The sedative potential of hydroalcoholic extract of whole herb of *S. indicus* (100,

200 and 500 mg/kg, p.o.) has been reported using experiments in which it reduced locomotor activity of mice, exploratory activity and potentiated pentobarbital induced sleep in mice.

Immunomodulatory activity

The immunomodulatory activity of *S. indicus* was explored by evaluating its effect on antibody titre titer, delayed type hypersensitivity response, phagocytic function and cyclophosphamide-induced myelosuppression in mice. Administration of methanol extract and its fractions (100 and 200 mg/kg, p.o.) showed immunostimulating activity. Methanol extract, and petroleum ether, chloroform and remaining methanol fractions of flower heads of *S. indicus* Linn. were found to be effective in increasing the phagocytic activity, haemagglutination antibody titre and delayed type hypersensitivity, whereas only remaining methanol fraction was found active in normalizing total WBC levels in the case of cyclophosphamide - induced myelosuppression in mice. Eudesmanolide type of sesquiterpene from *S. indicus* was reported to have immunostimulating activity.

Antioxidant activity

In an *in vitro* study, ethanolic extract of *S. indicus* (1000 ˝g/mL) showed maximum scavenging of the radical 2,2-azinobis-(3-ethylbenzothiazoline-6-sulfonate) (ABTS), 1,1-diphenyl, 2-picryl hydrazyl (DPPH), superoxide and nitric oxide radical. The extract also showed moderate scavenging activity of iron chelation. In an in vivo study, methanolic extract of *S. indicus* exhibited a significant antioxidant effect showing increasing levels of superoxide dismutase, catalase, and glutathione peroxides by reducing malondialdehyde levels in rats.

Anti-inflammatory activity

The herb showed anti-inflammatory activity by suppressing the capacity of *Propionibacterium acnes* induced reactive oxygen species and pro-inflammatory cytokines, the two important inflammatory mediators in acne pathogenesis. To prove the anti-inflammatory effects of *S. indicus*, polymorphonuclear leukocytes and monocytes were treated with culture supernatant of *P. acnes* in the presence or absence of the herb *S. indicus* (5 and 50 µg/mL). This caused a smaller, still significant, suppression of reactive oxygen species. The aqueous extract obtained from the root of *S. indicus* was found to be moderately active in down-regulating *P. acnes* induced TNF-α and IL-8 production. Another study has also reported its anti-inflammatory activity.

Analgesic and antipyretic activity

Petroleum ether, benzene, chloroform, ethanol and triple distilled water extracts of whole plant of *S. indicus*, obtained by successive solvent extraction, were screened for analgesic and antipyretic activity (200 and 400 mg/kg, p.o.) using Eddy's hot plate, tail immersion and brewer's yeast induced pyrexia methods, respectively. The petroleum ether, chloroform and ethanol extracts showed significant analgesic activity at both the doses from 1 hour onward as compared to the standard drug diclofenac sodium. The chloroform and ethanol extracts showed potential significant antipyretic activity from 1 hour onward, whereas aqueous extracts exhibited this activity from 2 hours onward as compared to the standard drug paracetamol amongst various extracts.

Mast cell stabilizing action

Ethanol extract (150 and 300 mg/kg) and ethyl acetate extract (100, 150 and 300 mg/kg) of *S. indicus* showed better protective action of mast cell degranulation in sheep serum induced allergy test and compound 48/80 induced allergy.

Antihyperglycemic activity

The 50% ethanolic extract of plant was reported to have hypoglycemic activity.[Antihyperglycemic effect of alcoholic extract of *S. indicus* was evaluated in the nicotinamide (120 mg/kg, i.p.) and streptozotocin (60 mg/kg, i.p.) induced diabetes in rats. Fasting plasma glucose levels, serum insulin levels, serum lipid profiles, magnesium levels, glycosylated hemoglobin, changes in body weight and liver glycogen levels were evaluated in normal and diabetic rats. Fasting normal rats treated with the alcoholic extract of *S. indicus* showed significant improvement in oral glucose tolerance test. Oral administration of *S. indicus* for 15 days resulted in a significant decrease in blood glucose levels and increase in hepatic glycogen and plasma insulin levels.[

Hepatoprotective activity

The hepatoprotective effect of aqueous and methanolic extracts of flower heads of *S. indicus* on acetaminophen-induced heptotoxicity was studied in rats. A significant decrease in liver function markers such as serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), acid phosphatase (ACP) and alkaline phosphatase (ALP), bilirubin and total protein, was observed while using methanolic extract of *S. indicus* (300 mg/kg, p.o.) in comparison with the same dose of aqueous extract. This fact was also confirmed by studying the liver histopathology of treated animals. Moreover, the methanolic extract of *S. indicus* enhanced the activities of antioxidant enzymes such as superoxide dismutase, catalase and glutathione peroxidase and diminished the amount of lipid peroxides against acetaminophen-induced hepatotoxicity in these animals.

Skin disease

Ethanolic extract of aerial part of *S. indicus* Linn. was evaluated for wound healing activity in guinea pigs. The cream containing the extract was applied *in vivo* on the paravertebral area of six excised wounded models once a day for 15 days. The cream significantly enhanced the rate of wound contraction and the period of epithelialization and this effect was comparable to neomycin. Various ointments of ethanolic extract of flower head of *S. indicus* in various proportions were screened for the assessment of wound healing activity in albino rats. Based on the comparison made of the wound healing activity of various formulations, the formulation comprising 2% (w/w) alcoholic extract of flower head of *S. indicus* was found to be superior to that of control and standard formulation. Hydroxyproline content was also found greater in healed wounds as compared to control and standard formulation.

Antimicrobial activity

A bicyclic sesquiterpene lactone isolated from the petroleum ether extract of the aerial part of the *S. indicus* was reported to have antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, *Fusarium* sp., *Helminthosporium* sp. and other microorganisms. Antimicrobial activity of alkaloidal and nonalkaloidal

fractions of alcoholic extract of flowers has also been reported.

Antibacterial and antifungal activities

Alcohol and water extracts of *S. indicus* were reported to have antibacterial activity against *Alternaria solani, Fusarium oxysporum and Penicillium pinophilum*. Ethanol extract of *S. indicus* has antibacterial activity against enteropathogens. Aerial parts of *S. indicus* show antibacterial activity against *Bacillus cereus var. mycoides, Bacillus pumilus, Bacillus subtilis, Bordetella bronchiseptica, Micrococcus luteus, S. aureus, Staphylococcus epidermidis, Klebsiella pneumoniae* and *Streptococcus faecalis*. Essential oil from the leaves of *S. indicus* has antibacterial activity against *Salmonella paratyphi A, Salmonella paratyphi B, Salmonella paratyphi C, Schigella Flexneri, Salmonella Enteritidis, Salmonella typhimurium, Shigella sonnei* and *Vibrio cholera*. The fruits of *S. indicus* exhibited excellent antibacterial activity against gram positive as well as gram negative bacteria. It also possesses antifungal property.Petroleum ether, acetone, methanol (90%) and water extracts of flowers were tested for antibacterial and antifungal activities by diffusion method in bacterial and fungal test cultures. All the extracts showed considerable antibacterial and strong antifungal activities. In another study, n-hexane, benzene, chloroform, ehtylacetate and acetone extracts of aerial parts and flowers of *S. indicus* were tested for antibacterial and antifungal activities using *in vitro* disk diffusion method at concentrations of 5, 2.5 and 1.25 mg/disk. The n-hexane extract of flowers showed significant activity against *S. aureus* and *Candida albicans*.

Antiviral activity

Methanol extract of *S. indicus* showed inhibitory activity against mouse corona virus and herpes simplex virus at a concentration as low as 0.4 µg/mL. The plant extract also exhibited antiviral activity against vaccinia and ranikhet viruses.

Larvicidal action

Acetone extracts of root and leaves of the plant (at concentrations of 750 and 1000 ppm) were shown to cause more than 50% mortality in a predominant Indian mosquito species which acts as a vector of filarial worm. Larvicidal activity was found to be higher in root extract than leaves extract. Purified fraction of acetone extract of *S. indicus* showed mosquito larvicidal effect. Methanolic extract of *S. indicus* showed repellent and feeding deterant activities against *Tribolium castaneum* at 1% concentration. Complete feeding deterent activity was observed at 5 mL dose, whereas repellent activity was noticed at 4 mL dose.

Macrofilaricidal activity

The methanolic extract of *S. indicus* (1–10 mg/mL) was screened for *in vitro* macrofilaricidal activity by worm motility assay against adult Setaria digitata, the cattle filarial worm. It showed macrofilaricidal activity at concentrations below 4 mg/mL and an incubation period of 100 minutes.

Nematocidal action

It produced toxic effects on the second and fourth instar larvae of Culex quinquefasciatar mosquito at 100-500 ppm concentration. The fourth instar larvae were more susceptible than the second instar larvae. Methanolic extract of dried fruit of the plant is reported to have nematocidal activity. The extract also

showed pupal intermediates and half acdysed. Root extract with acetone caused more than 50% mortality in all early instars, exhibiting more toxic potential than leaf extracts.

Bronchodilatory effect

The methanolic extract of whole plant of *S. indicus* Linn. and its various fractions (87 and 174 mg/kg, p.o.) were tested for their bronchodilatory effect against histamine-induced acute bronchospasm in guinea pigs. The methanolic extract and its fractions, viz., petroleum ether, benzene, chloroform and ethyl acetate exhibited significant protective action against bronchospasm induced by histamine in guinea pigs.

Antihyperlipidemic activity

Antihyperlipidemic activity of alcoholic extract of *S. indicus* Linn. flower heads in atherogenic diet induced hyperlipidemia was studied in rats. *S. indicus* extract (500 mg/kg/day, p.o. for 8 days) caused a marked decrease in body weight, total cholesterol, triglyceride, and low density lipoprotein and very low density lipoprotein. A significant increase in the level of high-density lipoprotein was observed after treatment with *S. indicus* extract.

Renoprotective effect

The ethanolic extract of *S. indicus* was evaluated for nephroprotective screening in gentamicin-induced acute renal injury in rats. Gentamicin-induced renal injury resulted in elevated biochemical markers, namely, blood urea and serum creatinine followed by a decrease in total protein and serum albumin. The histopathologic feature was that of acute tubular necrosis. The ethanolic extract of *S. indicus* at a dose level 300 mg/kg was found to normalize the above mentioned biochemical markers and bring about near to normal recovery in the kidneys as evidenced microscopically.

Miscellaneous activity

Extract of *S. indicus* has been reported to inhibit hyaluronidase. The alcoholic extract of flowers of *S. indicus* is reported to have hypotensive, peripheral vasodilatory and cathartic activities. The plant is also reported to have anticancer activity and antiprotozoal activity against *Entamoeba histolytica*.

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Neem as a biopesticide and medicine

Amit Tomar
Department of Botany, Meerut College, Meerut (U.P.) INDIA

Abstract
Azadirachta indica A. Juss. (Meliaceae) a large evergreen tree, leaves pinnate, flowers white and sweet-scented. Flowers appearing in the month of March-May and fruit ripen in July-August. Neem posses as a biopesticide in different levels. Oilcake of seeds is used as a fertilizer and manure to increase the productivity of plants. Substances Azadirachtin isolated from leaves and have insect repellent and insecticidal properties. Nimbin and Nimbidin compounds possess anti-viral activity. The main compounds of the oil are Nimbidin and Nimbin and possess anti-viral activity, which are used for making several pharmaceutical formulations and soaps including liquors, ointments and cosmetics such as creams, shampoos and hair tonic.
A whole plant has medicinally importance and leaves are used for tooth pastes and soaps. Tender twigs are commonly used as tooth-brushes and to prevent bacteria and pyorrhoea. Sap of Neem leaves is considered valuable in skin diseases. The juice of leaves with honey is prescribed to jaundice and skin diseases. Decoction of leaves is a bitter tonic and its action on liver and especially given to patient in chronic malarial fevers. An infusion of the flowers is a tonic and given in stomachic. A poultice of the flowers is applied to relief of nervous headaches. The fruits are prescribed for intestinal worms.
Keywords: Neem, Biopesticide, Fertilizer, Medicine

Introduction

The Neem tree is indigenous to India and it is used as anti-inflammatory; antipyretic, antiarthritic, antigastric, antimalarial ulcer, spermicidal, antifungal, antibacterial, diuretic, hypoglycaemic, antitumour, immunomodulatory. Neem oil, fruit and the different by products such as seed cake are used as bio pesticides, fungicides and organic manures. Recently, a number of agro-chemical businesses have realized the potential of Neem and there has been a growing interest towards Neem as an organic alternative to industrial pesticides. The action of Neem products as pest control agents can be manifested at different levels and in different ways. This is a very important point to be noted since the farmer would be used to the "knock-out'' effect of chemical pesticides. Neem extracts do not exhibit this type of effect on pests but affect them in several other ways.The significance of Neem as bio-pesticide was realized by the modern scientific community, as early as 1959, when a German scientist in Sudan found that Neem was the only tree that remained green during a desert locust plague. Literatures confirm that Neem can effectively get rid of over 200 pest species that affects plants. Neem extracts which is a growth regulator and as well as a powerful feeding. Azadirachtin is non-volatile and an insect cannot prevent it by smell but has to taste it, in order to respond to it. A taste of azadirachtin stimulates at least one 'deterrent neuron' in insects which show an anti-feedant response. The strength of 'deterrent neuron' responses has

been correlated with the strength of anti-feedant responses. Neem oil can also suffocate mites, whiteflies, aphids and other types of soft bodied insects on contact. So it is clear that Neem does not kill on contact, quite it inhibits feeding and reproduction of the pests. As a fungicide, Neem oil is mainly used as a preventative and when disease is just starting to show. It coats the leaf surface which in turn prevents the germination of the fungal spores. Neem oil is effective against rots, mildews, rusts, scab, leaf spot and blights. It is a very interesting property of Neem products and unique in nature, since it works on juvenile hormone. The insect larva feeds when it grows and it sheds the old skin and again starts growing. This particular shedding of old skin is the phenomenon of ecdysis or moulting is governed by an enzyme ecdysone. When the Neem components, especially Azadirachtin enter into the body of larvae, the activity of ecdysone is suppressed and the larva fails to moult, remains in the larval stage and ultimately dies. If the concentration of Azadirachtin is not sufficient, the larva manages to enter the pupal stage but dies at this stage and if the concentration is still less the adult emerging from the pupa is 100 % malformed, absolutely sterile without any capacity for reproduction. Perusal of literatures on Biopesticide and Medicine, Khan and Wassilew 1987; Vanna 1976; Singh *et al.* 1996; Jacobson 1995; Ketkar and Ketkar 1995; Kraus 1995; Schmutterer 1995 and Vijayalakshmi *et al.*1995. In this present study a description of Neem used as a Biopesticide and medicine.

Neem used as a biopesticide

Neem is decomposed only slowly, leading to a slower release of nutrients contained in it. The slow release of nutrients is attributed to the presence to the various extractable principles in seed and cake and

***Azadirachta indica* A. Juss.**

these extractives are used as rewarding adjuvant for nitrogenous fertilizers such as urea. It is estimated that out of the total quantity of urea applied to crops, about 50-70% is lost in various forms, thereby reducing the availability of nitrogen to crops. There is an age old practice in India of blending Neem cake with urea. When Neem cake is blended with urea, it forms a fine coating and protects the loss of Nitrogen by denitrification ensuring regulated continuous availability of nitrogen for a longer period, as per the requirement of crops. Neem seed cake also stimulates the phosphorus uptake slightly but had no effect on potassium uptake. The natural insecticides, fungicides and bio-pesticides made out of Neem have many advantages. Research studies indicate that they are not harmful to humans or animals. The pests will not develop resistance over generations while the beneficial insects like butterflies, ladybugs, etc are spared. The soil is enriched and extracts leave no residue in the environment.

According to the World Health Organization, misuse or overuse of chemical pesticides result in poisoning of about 500,000 people resulting about a million illnesses and about 20,000 deaths in the Third World alone. Substituting crude Neem extracts for expensive chemical controls saves both money and lives. In developing countries, most of the earnings of farmers are spent on crop protection chemicals. These results in a nasty cycle of continued debt and thereby the poverty, ill health and environmental degradation.

Neem used as a medicine

Many compounds have been isolated from different parts of Neem. Nimbidin, a major crude bitter principle extracted from the oil of seed kernels of *A. indica* demonstrated several biological activities. From this crude principle some tetranortriterpenes, including nimbin, nimbinin, nimbidinin, nimbolide and nimbidic acid have been isolated. Neem has medicinally importance and leaves are used for tooth pastes and soaps. Tender twigs are commonly used as tooth-brushes and to prevent bacteria and pyorrhoea. Sap of Neem leaves is considered valuable in skin diseases. The juice of leaves with honey is prescribed to jaundice and skin diseases. Decoction of leaves is a bitter tonic and its action on liver and especially given to patient in chronic malarial fevers. An infusion of the flowers is a tonic and given in stomachic. A poultice of the flowers is applied to relief of nervous headaches. The fruits are prescribed for intestinal worms.

Result and discussion

The species occurs very common as a large tree and plant grows in mostly all parts of India. This knowledge is handed down to generations through word of mouth and is extensively used for the treatment of various ailments as well as used bio-pesticide. Neem checked to growth of bacterial infection. It is used as insecticides and fungicides. Thus Neem is used to preparation of Ayurvedic medicines as a traditional remedies and it is used to cure for different diseases.

Conclusion

The research article has shown that bio-pesticide made from natural botanical source such as leaves and seeds of Neem to use insecticides prepared from natural raw materials and it has not adverse effects on human health. Thus Neem is also used in the treatment of various ailments without any side effects.

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Diversity of macro-fungi in central India-IV: *Auricularia auricula-judae*, a neutraceutical jelly mushroom

R.K. Verma and Poonam Verma
Forest Pathology Division
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Jabalpur -482 021, Madhya Pradesh

Introduction

Auricularia auricula-judae (Bull.) Quél., is known as the Jew's ear, wood ear or jelly ear, it is a species of edible Auriculariales fungus found worldwide. The fruiting body is distinguished by its noticeably ear-like shape and brown colouration. It grows upon wood, especially elder one and also as is a weak parasite (on living wood) (Harding, 2008). It also causes white rot **(**Worrall et al., 1997). The species was first mentioned in the scientific literature as *Tremella auricula* by Linnaeus in his 'Species Plantarum' in1753 and later described by Jean Baptiste François Pierre Bulliard as *Tremella auricula-judae* in 1789. Bulliard transferred the species to the genus *Peziza*. It was transferred to *Exidia* by EM Fries in 1822. In 1860, Miles Joseph Berkeley described the species as a member of *Hirneola* now considered synonymous with *Auricularia*. The species name, *Auricularia auricula-judae* was given the by Joseph Schröter (Quélet, 1886; Schröter, 1888). This name comprises *auricula*, a Latin word meaning *ear*, and *Judae*, meaning *of Judas*. The species has a wide distribution of showing its ability to grow upon many different kinds of wood, and showed great variation in size, colour and shape. Common names for the fungus which refer to Judas can be traced back to at least the end of the 16th century. The fungus yields a famous medicine, in quinsies, which cure sore throats, and strangulations.

Auricularia auricula-judae is for the first reported on branches of living trees, *Mangifera indica* and *Azadirachta indica* India.

Materials and methods

Collection of samples

The mushroom was collected on branches of a living tree of *Mangifera indica* and *Azadirachta indica* from Jabalpur, MP, 28.6.2013 by R.K. Verma and on *Anogeissus latifolia,* Kanker, CG. The specimen were deposited in the mycology herbarium of Forest Pathology Division, Tropical Forest Research Institute, Jabalpur, India under accessesion Numbers, TF 3432 and TF3275.

Identification of fungus

Identification of fungal fruiting bodies has done with help of relevant literature (Acton and Sandler, 2001; Barrett, 1910; Boa, 2004; Harding 2008; Lowy, 1952; Mohanan, 2011; Sterry and Hughes, 2009; Tiwari et al., 2013; Verma et al., 2008; Young and Smith, 2005) and internet.

Results and discussion

Taxonomic description

***Auricularia auricula-judae* (Bull.) Quél. (Figures 1-6)**

Basionym: *Tremella auricula-judae* Bull.

Synonyms:

Auricularia auricula (L.) Underw.
Auricularia auricula-judae var. *lactea* Quél.
Auricularia auricularis (Gray) G.W. Martin
Auricularia lactea (Quél.) Bigeard & H. Guill.
Auricularia sambuci Pers.
Exidia auricula-judae (Bull.) Fr.
Gyraria auricularis Gray
Hirneola auricula (L.) H. Karst.
Hirneola auricula-judae (Bull.) Berk.
Hirneola auricula-judae (Bull.) Berk. var. auricula-judae
Hirneola auricula-judae var. *lactea* (Quél.) D.A. Reid
Hirneola auricularis (Gray) Donk
Merulius auricula (L.) Roth
Peziza auricula (L.) Lightf.
Peziza auricula-judae (Bull.) Bolton
Tremella auricula L.

Classification

Kingdom:	Fungi
Division:	Basidiomycota
Class:	Agaricomycetes
Order:	Auriculariales
Family:	Auriculariaceae
Genus:	Auricularia
Species:	*A. auricula-judae*

Fruiting bodies commonly growing solitarily, it can also be in a group or caespitose, normally 3 to 8 centimeters across (Fig. 1-2). Hairs on the fruit body are from 85 to 100µm in length, and 5 to 6µm in diameter (Fig. 3). It is distinctively shaped, typically being reminiscent of a floppy ear, though the fruit bodies can also be cup-shaped. It is normally attached to the substrate laterally or by a very short stalk. The species has gelatinous, elastic texture when fresh, become hard and brittle when dry. The fruit bodies lost 90% of their weight through dehydration. Fruit bodies found all year, but are most common during rainy season and in autumn. They are hyaline, lack a central strand and have rounded tips. The outer surface is a bright reddish-tan-brown with a purplish tint, often covered in tiny, downy hairs of a grey colour. It can be smooth, as is typical of younger specimens, or undulating with folds and wrinkles. The colour becomes darker with age, inner surface is lighter grey-brown and smooth. It is sometimes wrinkled, again with folds and wrinkles, and may have 'veins', making it appear even more ear-like (Fig. 6). The spores can sometimes be seen in a whitish mass on the underside of the fruit body. The species has elongated cylindrical basidia with three transverse septa (internal cross-walls dividing the hyphae). Basidia 60-72 x 4-7.5 µm; sterigmata lateral, well developed, 3-4.5 µm long (Fig. 4). The basidiospores white-cream or yellowish, hyaline smooth, long and sausage shaped, reniform-allantoid, guttulate, measuring 14 - 18µm x 6 - 8 µm (Fig. 5). Spores are ejected from the underside of the fruit bodies with as many as several hundred thousand an hour, and the high rate continues when the bodies have been significantly dried.

Collection examined

On branches of a living tree of *Mangifera indica* and *Azadirachta indica*, Jabalpur, MP, 28.6.2013, R.K. Verma, on *Anogeissus latifolia*, Kanker, CG

Figure 1-2. ***Auricularia auricula-judae,*** fruit bodies on a branch of mango tree

Figure 3. ***Auricularia auricula-judae,*** cross section of fruit body showing zona pilosa and internal structures and hair on the upper surface

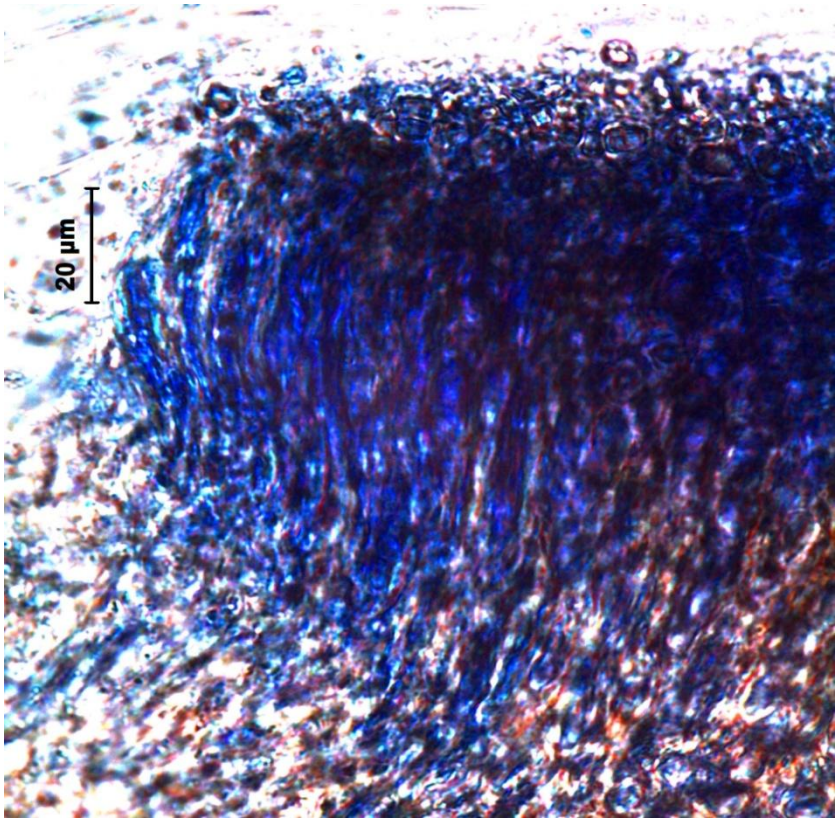

Figure 4. ***Auricularia auricula-judae,*** cross section of fruit body showing basidia

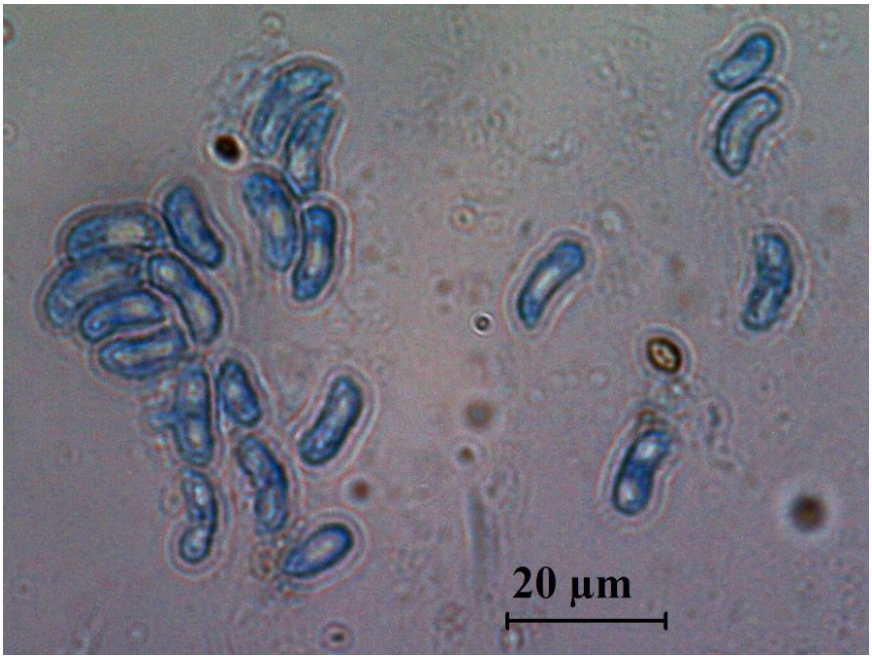

Figure 5. ***Auricularia auricula-judae,*** basidiospores

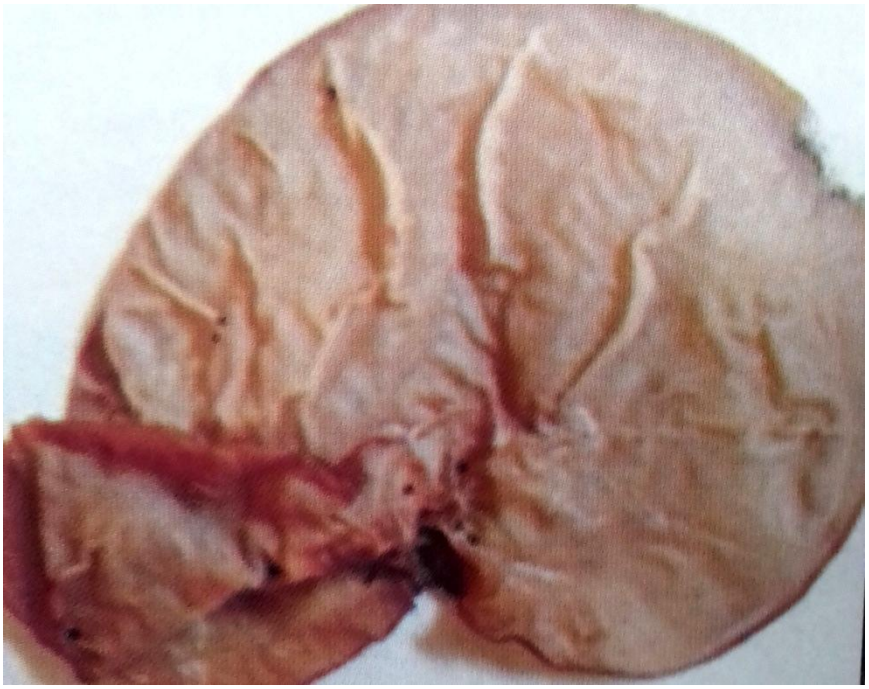

Figure 6: ***Auricularia auricula-judae*** on *Anogeissus latifolia*, fruiting body showing ear like structure

Hosts

Wood of deciduous trees and shrubs, favoring elder one, *Acer pseudoplatanus*, beech, ash, spindle, sycamore, dead or dying branches of trees, on main trunk, decaying logs, etc., growing in wet evergreen and shola forests, *Eucalyptus* woodland and rainforests, on fallen logs, on branches of a living tree of *Mangifera indica*, *Azadirachta indica* and on logs of *Anogeissus latifolia*. De (1999b) has also reported this fungus as a mycoparasite on *Schizopora paradoxa*.

Distribution

Europe (United Kingdom)**,** North America, Asia (in India semi-evergreen to evergreen and wet evergreen shoal forests of Western Ghats, Madhya Pradesh), Australia, South America, and Africa

Artificial cultivation technique

The temperature of about 20-25°C and air humidity of 50%-60% is suitable for spawn running but fruiting needs over 80% humidity. Span running and fruiting need ample amount of oxygen and little carbon dioxide it does not need light. The value of pH for hyphas growing is about 6-6.5. Choose new rice straw, sawdust of broadleaf tree, corncob, and fresh cottonseed bran as raw material of compost. Supplementary materials of compost are: wheat bran, rice bran, plasters stone and quick lime, etc. in the following proportions:

1. Sawdust 78%, rice bran 20%, sugar 1%, plaster stone 1% dry compose: water 1: 1.2~1.3
2. Sawdust of broadleaf tree 78%, wheat bran 15%, soya flour 2% quick lime 0.3%, plaster stone 0.2%
3. Sawdust 56.5%, corncob 30%, wheat bran 16%, bean cake 2%, quick lime 0.5%, plasters stone 0.5%

Making compost, firstly it must be evenly mixed, secondly, moisture content must be well controlled, and thirdly, the value of pH must be just right and fourthly the

contamination must be stopped. Bags used for planting *Auricularia auricula-judae* is a polypropylene plastic of 17 x 33 cm. 500g dry compost should be filled per bag. Sterilization of compost is done to stop contamination. Bags in autoclave/ pressure cooker must not arrange too close and air leak should be prevented. The bags can be inoculated when room temperature falls to about 30°C. The inoculation room should be disinfected 1-2 days before inoculation. The tools of inoculation must be cleaned and lighted with 75% alcohol. The hands of attending personnel should be washed with soap and cleaned with 75% alcohol. Put 4-5 grains of spawn in bag and press it with hands to let the spawn and compost contact fully. Stuff cotton plungers are put into the bag in the end.

The cultivation bed should have been prepared about 10 days before inoculation. Choose a place for cultivation that is a high, well ventilated and easy to drain off water. The bed is 1.5 m wide. There is a way for work between beds. Dry the beds in the sun a few days, then spread 1-2 cm river sand upon the surface of the bed. Spread a coat of quick lime upon the sand. Arrange the bags one by one. Cover with curtain type cover-hay. The main tasks 20 days before spawn running is shading and keeping air humidity, keep the temperature at 20-25°C. Hyphas will reach 1/3 length of the bag 20 days later. Look to ventilation at this moment. Check the bags whether have communicated competitor or not. If yellow, red, green or blue, etc. spots appear in the bags, that tells us the bags have contaminated by competitor. Inject the affected part, if it is not serious with formalin, move the bags to another room and culture them alone. Deeply bury the bags that have been seriously communicated by competitor or burn them to avoid polluting circumstance. The hyphas will reach the bottom of bags after about 50 days. Yellow or black water drops will appear on the surface of compost.

Put the surface of the bed in order again. Take away the bags and sprinkle plenty of water on the surface of the bed. If find insects, sprinkle insecticide once. Cut the mouth of bag along the lower part of collapsible when water has seeped into the bed. Then convert it upon the surface of the bed and there must be interspaced between bags. Cut a tear every 5-6 interval to induce fruiting. Commonly a bag can be cut three lines from top to bottom, 10-12 tear each line. The shape of each tear is like "v". Each tear is about 1.5 cm square. The purpose of cutting tears is to increase illumination and stimulate fruiting. The humidity must be above 80%. Cover the bags with a straw curtain. If the humidity is not high enough, sprinkle some water on the curtain with sprayer and cover the straw curtain with a sheet of plastic film. The fruit body will grow about ten days later.

Pick the fruit body, as it is 80% ripe. Stop sprinkling seven days after picking. Culture the bags in dark and promote the continuous growth of fruit body. Commonly three crops would be harvested. There are more 20 days between flashes. The output of first crop occupies 50% of total output. Dry the fruit body by airing, drying in the shade would be best. Don't dry in the sun. Then the fruit body after drying can go on the market (unicornbags.com/cultivation/auau.shtml) (page visited on 17.1.2017).

Economic importance

Auricularia auricula-judae has a soft, jelly-like texture. Though edible, it was not held in high culinary regard in the west for many years. It has a mild flavor, and is useful for mixed mushroom recipes, but is still considered bland in the west. It can be dried and rehydrated, sometimes swelling to a very large size. Young specimens are best, but the species is not edible when raw, needing to be cooked thoroughly. The whole fruit body can be eaten, but should be thoroughly washed before cooking. Cooking can sometimes take a comparatively long time. The nutritional content of 100g of dried fungus is presented in Table 1. Fresh mushrooms contain about 90% moisture. Dried specimens may be ground up into a powder and used to absorb excess liquid in soups and stews, as it rehydrates into tiny fragments. Wood ear mushrooms are popular for their ability to add texture to soups (Chinese hot and sour soup), stir-fry and use as salad.

Table 1. Nutritional composition of dried fruit bodies of *Auricularia auricula-judae*

Nutritional value per 100 g dried fruit body	
Energy	284 kcal (1,190 kJ)
Fat	0.73 g
Protein	9.25 g
Minerals	
Calcium	(16%) 159 mg
Iron	(45%) 5.88 mg
Phosphorus	(26%) 184 mg

Si Units, µg =micrograms, mg =milligrams, IU =International unit
Source: USDA Nutrient Database

Auricularia auricula-judae has been used as a medicinal mushroom by many herbalists. It was used as a poultice to treat inflammations of the eye (Mabey, 1984) as well as apalliative for throat problems. The 16th-century herbalist John Gerard, writing in 1597, recommended this fungus for preparation of a liquid extract to cure a sore throat similar to the Chinese soups that prepared from *A. polytricha*. Carolus Clusius, writing in 1601, also said that the species could be gargled to cure a sore throat (Barrett, 1910). Writing in 1694, herbalist John Pechey described *A. auricula-judae* reported it is good to gargle the mouth or throat for cure of Quinsy, and other inflammations of the mouth and throat. When infused in water, it is good in Diseases of the Eyes. There are recorded medicinal usages from Scotland, where it was again used as a gargle for sore throats, and from Ireland, where, in an attempt to cure jaundice, it was boiled in milk (Applequist, 2004). Medicinal use in Indonesia was also recorded in the 1930s (Boa, 2004) and was more recently reported in modern-day Ghana. A report for the 2005 Commonwealth Forestry Conference examining the possible effects of deforestation in southern Ghana on medicinal and edible fungi found that *A. auricula-judae* was in use as a blood tonic (Apetorgbor *et al.*, 2005). Experiments in the 1980s concluded that two glucans isolated from the species showed potent anti-tumour properties when used on mice artificially implanted with Sarcoma 180 tumours (Misaki *et al.*, 1981). Its show many biological activity like Hypoglycemic, Hypocholesterolemic**,** Anticoagulant Activity, Antioxidant Activity / Hypocholesterolemic**,** Anticomplement Activity**,** Polysaccharide Flour / Antioxidant, Anti-Tumor Activity, Hypolipidemic, Cerebral Ischemia/ Reperfusion Injury Protection,

Comparative Anti-Tumor Activity, Inhibition of Tumor Cell Growth In-Vitro, Anti-Inflammatory, Antioxidant/ Functional Formula Diet, Polysaccharide Antithrombotic Effect, Blood Lipids and Bone Density Effect in Middle Aged Obese Women, Exercise Endurance Effects, Fruiting Bodies Melanin/ Natural Colorant**,** Wound Healing Effect/ Polysaccharides **(**www.stuartxchange.org/Tainga n-daga**)** (page visited on 17.1.2017.

Further, research on genetically diabetic mice showed that a polysaccharide extracted from *A. auricula-judae* had a hypoglycemic effect; mice fed with food including the polysaccharide showed reduced plasma glucose, insulin, urinary glucose and food intake. Another chemical extracted from the species was an acidic polysaccharide, which showed anticoagulant properties. The article concluded that the polysaccharides from these mushrooms may constitute a new source of compounds with action on coagulation, platelet aggregation and, perhaps, on thrombosis. Research has shown that *A. auricula-judae* can be used to lower cholesterol levels (Yuan et al., 1998).

Acknowledgement

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Major causes leading to the destruction of Sierra Leone forest estate

Moses Fayiah
School of Natural Resources Management, Njala Campus.
Department of Forestry
Njala University, Sierra Leone

Abstract
Sierra Leone's forestry and wildlife sector policy has been inadequate in addressing contemporary issues in forestry governance and management for the past decades. The Forestry Act of 1988 remains the principal legislation guiding the management and regulation of forestry and forest reserves within the country. The major causes of forest destruction in Sierra Leone are shifting cultivation, logging, fuel wood collection, charcoal production, infrastructural development, poverty, wildfire and mining. Other minor causes such as browsing, rodent's hunts, arson and societal activities are also considered a threat but at low level. Political interference in managing forest resources, weak management policies and outdated colonial forest exploitation acts with inefficient penalties have led to the lawless and mass destruction of forest resources throughout the country. Furthermore, inadequate training and attitude of some forestry staff country wide greatly contribute to the current status of our forest by turning blind eyes to illegal logging.It is recommended that the government, local communities and all stalk holders in educational institution in Sierra Leone put hands on deck and carry out mass reforestation and afforestation drive of degraded lands as well as engaging in sensitization campaign with posters and hand bids if Sierra Leone is prepared to preventfurther forest degradation and mitigate climate change in the near future. Identified possible actions for mitigating and reducing forest destruction in Sierra Leone include; sound and robust forest management and protection act to be instituted urgently, enforcement of formidable punishment for defaulters, incorporate forestry science into school syllabus, employ more dedicated forest guards and promote forest management on various media in the country.

Keywords: Destruction, degradation, deforestation, environment, forest.

Introduction

Sierra Leone was once a well forested country in the early 90s, but the closed forest cover has been reduced from about 70% of the total land area in about 7 decades period to only 5% of land area in 2000 (Allieu, 2011). Decreases in forest cover are the result of multiple factors including clearing for agriculture, logging (both legal and illegal), mining, construction, fuel wood, and charcoal production to name but a few. Along the coastal areas, mangrove forests cover approximately 286,000 hectares but these forests are also threatened by unregulated use of wood for construction, wood for smoking fish and fuel wood. The major causes of deforestation are anthropogenic in nature including shifting cultivation, wild fires, fuel wood and charcoal production, mining of minerals

such as diamond, iron ore, stone and sand mining. Recent statistics shows that the annual round-wood removals nationally for firewood and charcoal accounted for about 95% while 3% for construction poles and 2% for timberbut post war rehabilitation efforts have clearly changed the trend for the worst because of increased pressure on construction poles. Sierra Leone has substantial mineral reserves in the form of diamonds, bauxite, gold, iron, marine's reserves to name but a few but still depends heavily on slash-and-burn agricultural practice in rural areas. Timber logging, clearing forest for cattle grazing, fuel wood collection, and mining have contributed to the dramatic drop in forest cover in Sierra Leone since 1980.Between 1990 and 2000, Sierra Leone lost an average of 19,300 hectares of forest per year. This amounts to an average annual deforestation rate of 0.63%. Between 2000 and 2005, the rate of forest change increased by 0.68% to 7.3% per annum. In total, between 1990 and 2005, Sierra Leone lost 9.5% of its forest cover, or around 290,000 hectares (Table 1). Until 2002, Sierra Leone lacked a forest management system due to a brutal civil war that resulted in tens of thousands of deaths and the displacement of more than 2 million people about one-third of the population(Butler , 2006).

Table 1: Change in forest cover from 1990-2005

Total Forest Cover From 1990-2010	ha	
Forest cover 1990 (ha)		3.044.000
Forest cover 2000(ha)		2.851.000
Forest cover 2005 (ha)		2.754.000
Annual change 1990-2000 (ha/%)	(19.300)	-0.63%
Annual change 2000-2005 (ha/%)	(19.400)	-0.68%
Total change 1990-2005 (ha/%)	(290,000)	-9.53%
Change in rate (%)		7.32%

Source: (Butler, 2006)

The decline of forest in Sierra Leone presently has mostly been blamed on logging, agriculture, infrastructural development and investors but logging usually starts the degradation of the environment. In some case logging and mining go hand in hand causing a lot of destruction not only to the vegetation but also the land which is torn apart. As a result of these activities, valuable timber species along the coastal became exhausted in the 19th and 20th centuries (Omiyale, 2008). Along the coastal areas mangrove forest cover approximately 286,000 hectares but these forests are also threatened by unregulated use of wood for energy, fish drying and boat making.

The direct driver of deforestation in Sierra Leone for the past decades is agriculture through shifting cultivation practices or the slash and burn method of farming mostly practiced in rural areas. Other important drivers are logging (both legal and illegal), mining, and unregulated use of wood for

construction and fuel wood as well as for charcoal production (GOSL, 2010). Despite their large extent, rapid growth and increasing importance at the local, national and regional levels for the products and service they provide, forest are not afforded adequate prominence in forest policy, planning and research. There is a general lack of policies regulating and encouraging forest management, use and conservation (NCCP, 2015). From 2001 to 2014, the tree cover loss of Sierra Leone amounted to 498,424 ha over the fourteen years period (Figure 1).

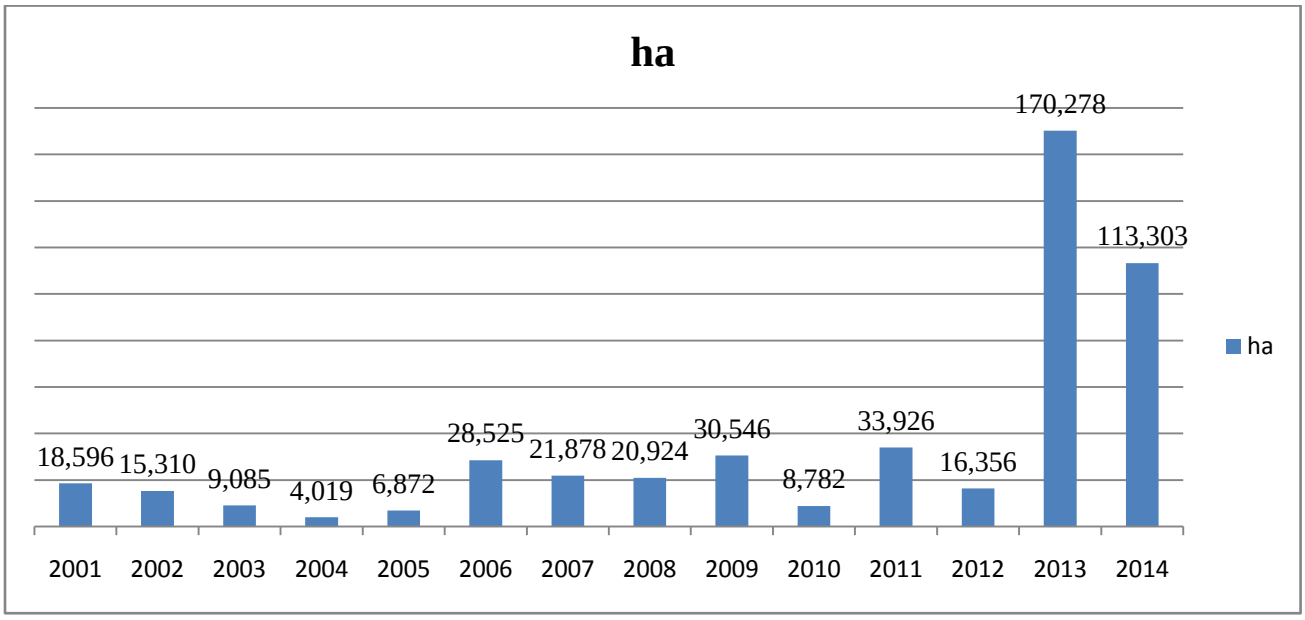

Figure 1: Tree cover loss from 2001-2014 (Source: Global forest watch, (2014))

The above figure, clearly described the trend of forest destruction according to years with 2014 and 2013 being the worst years in forest destruction history in Sierra Leone. Consequently, nothing much has been done about this skyrocketed rate of forest resources depletionnationwide and the worst is still to happen.

Materials and methods

Sierra Leone is located in the West coast of Africa between the 7th and 10th parallels north of the equator and shares borders with Liberia in the Southwest and Guinea from Northeast to the Northwest with an area of 27,699 sq mi (71,740 sq km). A mean annual rainfall of 2500-5000mm common along the Atlantic coast but however, decreases to 2000 mm on the northern border. Sierra Leone has a hot tropical climate with two pronounced seasons: a rainy season from May to November, and a dry season from December to April. The rainy season has weather patterns occurring in the following order: thunderstorms and squalls for some months, steady rains then thunderstorms and squalls again. The country has four main physiological regions, which run approximately northwest to southeast direction. They are the coastal plains, interior plains, interior plateau and the

Freetown Peninsular Mountains and hills (FAO/ UNDP, 1979).

Vegetation

The country currently display moderate variety of vegetation such as closed high forest, secondary forest, forest regrowth, farm bush in the up land terrain. Mangrove swamp, inland valley swamp, grassland, bolilands characterized the lower terrain. Both the high forest and tropical rain forest exhibits unique characteristics such as closed canopy 28-32 meters with big trees with diverse plant species and abundant rain fall.

Current socio-economic situation of Sierra Leone

The current population of Sierra Leone is estimated at 6.6 million people increasing at the rate of 2.7% per annum giving a population density ofabout 58 persons/km²standing on an area of 72,000 km² (Sierra Leone Population 2016). Access to clean drinking water was limited to only 60% of population in 2015; life expectancy at birth in 2016 is 51.683 for men and 52.248 for women.About 60% of the population is below the poverty line defined as earning less than 1 USD per day (World Bank, 2010).

Data collection

The data collection method employed was mainly desk review of relevant forest literatures, observation and personal communication with Districts Forest Officers, and other important environmental stalk holders in society.

Activities leading to the massive forest resources destruction in Sierra Leone

Sierra Leone is a developing country that has just emerged from a civil war in 2003, and is faced with numerous challenges in combating the skyrocketed increase in forest resource depletion nationwide. After the civil war that left thousands of homes destroyed, thousands killed, and thousands becoming poorer, the forest was the only source of survival for the grass root population. Supplying fuel wood and charcoal became a lucrative job for ordinary Sierra Leonean as the energy need of the capital city Freetown becomes a problem simply because electricity availability in the city was barely enough for the congested capital. Logging and mining also increased as there was no effective monitoring and law strong enough to immediately stop illegal logging and mining nationwide.Other threat facing forest resources of Sierra Leone are: poverty, urban development, population growth, political instability, shifting cultivation, charcoal burning among others. Generally, human activities have been the major causes of forest and land degradation in Sierra Leone through the following ways: shifting agriculture, deforestation, urbanization, grazing, infrastructural development, charcoal production and mining (NAP, 2010).

Logging

Logging isamong the main principal culprit of environmental degradation and destruction throughout the world. Indiscriminate logging is the order of the day in Sierra Leone with little or nothing being done to bring it to a halt especially when top ranking officials secretly have their hands in it. The importation of chain saws from neighboring Liberia and Guinea during the civil conflict and their unregulated use in Sierra Leone contributed

immensely to forest degradation in Sierra Leone (Ikotun and Algali 2006). Illegal logging is very common in Sierra Leone and the sawn timber mostly transported at night to avoid tax payment and police interrogation. The demographic pressure on and exigencies over the years have created the need for the exploitation of timber with a direct effect on the land resources. In Sierra Leone, timber is used mainly for housing, furniture, boat building and export. The following are timber species exploited in Sierra Leone; Mahogany-*Khayaanthotheca, Entandrophragma utile, E. angolensi, E. cylindricum, the African walnut PlakenetiaconophoraTetracarpidiumconophorum , African cedar - Afzeliaafricana , African oak - Oldfieldiaafricana, African teak-Chlorophoraexcelsa, Terminaliaivorensis, Terminalia. superba, Piptadeniastrumafricanum, Danielliathurifera, Klainedoxagabonensis, Brachystegialeonensis, Albiziaferruginea, Parkiabiolor, Xyliaevansii, Ricinodendronheudelotii, Hannoaklaineana, Irvingiagabonensis, Mimusopsheckelii, Cathormionaltissimum, Amphimaspterocarpoides, Cynometraleonensis, Tieghemellaheckelii, Heritierautilis, Lophiraprocera, Sacoglottisgabonensis, Triplochitonscleroxylon, Parinariexcelsa, Busseaoccidentalis, Pentaclethramicrophyllaetc* (Savill and Fox, 1967, Cole 1993, and Deighton, 1957). Logging target large trees and hence these trees are cut and removed, they destroy small flora and fauna along the part they fall thereby exposing the land surface. As a result of indiscriminate logging, valuable and economic tree species are being destroyed on a daily basis (NAP 2010).

Mining

Mining in Sierra Leone is characterized by known deposits of rutile (a major source of titanium), bauxite (used as an abrasive and catalyst), titanic iron ore, diamonds, gold, chromite (a major source of chromium), platinum, lignite (brown coal), clays, and base metals such as copper, nickel, molybdenum (used to strengthen and harden steel), lead and zinc. In Sierra Leone, mining is a major contributor to the Gross National Product of the country.However, it negative consequences are enormous. The mining industry plays a significant role in the destruction of forest ecosystems and in consequence ecological problems on a daily basis. The main minerals mine are Diamonds, Bauxites, Rutile, Iron ore and Gold which may involve various degrees of land clearance and excavation. Illicit mining is common in Sierra Leone and is mostly practice by disgruntle and unemployed youth with support from local business men in exchange for low price of minerals without paying any tax (World Bank, 2010). In Sierra Leone, only big companies take mining license and pay mining taxes, while grass root groups of three or four or above young men never pays task but yet cause massive deforestation with their surface mining practice.

Wildfire

Wildfire is common during the dry season especially in the northern part of Sierra Leone where savanna grass is the major vegetation with extreme temperature as compared to other regions of the country. At rural level, people use wildfire as cheap

labor for their farming activities and hunting. However, the negative impact is more than the positive impact because fire outbreak destroys anything along its path. Sometimes-even human beings are burned when not controlled properly. Wildfire in Sierra Leone is mostly caused by shifting cultivation, careless smokers, children hunting rodents, honey harvesters etc. Reliable statistics on wildfire in Sierra Leone is limited but some 200,000ha of land area is estimated by the National Environmental Plan as an average area affected by wild fires every year. The ecological effects that result from the frequent occurrence of wildfires in Sierra Leone include retardation in the development of natural vegetation towards a forest climax, the arrest of vegetation growth in some areas of the country and the prevalence of a permanent savanna situation (FAO, 2011).

Poverty

Sierra Leone was rated 183 out of 187 countries on the UN's 2014 human development index (www.heritage.org/index/country/sierraleone). Poverty is a force to reckon with in Sierra Leone and it is blamed onmostly corrupt government officials because the country is rich in mineral resources but development is not realized. It is one of the biggest indirect threats to national development, educational advancement, natural resources management and peace in Sierra Leone. Majority of the population in rural areas depends entirely on natural resources such as forests for their livelihoodsas 60% of the population is living below poverty line. These poor especially in rural areas depend on biodiversity for food, fuel, shelter, and medicines. Such high demands coupled with unsustainable practices of exploitation and utilization has placed undue pressure on the natural resource base and had a considerably negative impact on biological diversity as well (SLBTFA, 2007).

Infrastructural development

After the bloody civil war that last for 12 years and kill tens of thousands and destroyed 8,000 or more homes, infrastructural development became a major priority in urban and peri-urban areas. Government land grabbing/encroachment became the order of the day most especially around the Capital city Freetown. This situation resulted in Government lands being cleared by youth or some influential community members who later partitioned this lands and sell at their own price. The persistent pressure from infrastructural development is depleting forest resources at an alarming rate and encouraging desertification and land degradation faster than projected. Through this encroachment, forest reserves are cleared, water reservoir storage capacity altered, secondary farm bush destroyed, green belt demarcation ignored and vegetation permanently destroyed for settlements. These activities have exposed the high hills in the city leaving residents down the hills venerable to big rolling stones, flooding and heavy erosion as seen in the 2015flooding of Freetown city.

Shifting cultivation

Slash and burn is the most popular farming practice in Sierra Leone, especially in rural areas and it involves total clearing and burning of forest for farming. This method

of farming has been practiced since colonial days and it's still the major form of farming in Sierra Leone. This practice has contributed to the conversion of virgin forestlands to ordinary savanna and farm bush on a yearly basis. At rural level, shifting cultivation is the major source of food security, income and livelihood activities and the common means of growing food for every day survival on communal lands. The increase in population both in cities and at village levels is not only affecting the fallow period but also depleting forest resources at an alarming rate with little or no action being taken to combat the situation (GoSl 1989). This practice is the major culprit of forest resources destruction country wide and yet much is not being done by the state actors to introduced and encourage mechanized farming as other developing nations has done so as to control or minimize forest resource depletion.

Figure 2: shifting cultivation (Source; www.alamy.com cpx93g)

Fuel wood and charcoal production

Sierra Leone is among the least developed nations in the world with almost 90% of its population depending on fuel wood and charcoal for it energy need on a daily bases. At rural level the only means of preparing food that need cooking before consumption is through firewood and charcoal use. With the increase in the population and poverty rate, the greater reliance on fuel wood and charcoal energy, have led to forest exploitation at a serious and devastating level. The lack of employment in the country has led to so many young men and women to charcoal burning and fire wood collection on a large commercial scale for sustenance and survival (World Bank 2010).

The role of government in tackling forest degradation in Sierra Leone

Good governance is fundamental to achieving positive and sustained development outcomes in the forest sector, such as efficiency in resource management, an increased contribution to economic development and environmental services, and an equitable distribution of benefits (FAO and ITTO, 2010).

Sierra Leone's forestry and wildlife sector policy has been inadequate in addressing contemporary issues in forestry governance and management for the past decades. The

Forestry Act of 1988 remains the principal legislation guiding the management and regulation of forestry and forest reserves while the Wildlife Conservation Act of 1972 guides the management and regulation of wildlife and protected areas (GoSL, 1988).

Since 1988, the most completedforest management document is the draft forestry and wildlife sector policy design in 2015, which is yet to be formallyadopted by the government of Sierra Leone. The 2015 draft policy however, includes a wide- range of protection pre-amble covering background issues and external sector policies especially the overlapping mandates in ministries when it comes to access and protection of the forest but fail to address the pressing sustainable management component which is lacking in the forestry sector. The documents if adopted and implemented as written, it could halt the lawless encroachment and destruction of protected areas as well as forests reserves to some extent. In 2008, Forestry Division started a process of restructuring in order to strengthen the institution's capacity to effectively carry out its mandate. This initiative created three key functional units within the division, and two other units for financial and administrative support that cut across the three key functional units. These three functional units are the Commercial Forestry unit, the Community Forestry Unit, and the Conservation and Wildlife Unit. However, the problem of forest depletion in Sierra Leone goes far beyond creating white collar functional unit offices while the actual management of the remaining forests is of little priority to decision makers. Also, development exploitation and trade reforms were introduced with cabinet approval of regulations. The reforms standardized the processes and guidelines for leasing Community and Forest Reserves, issuing logging permits, use of stumpage fees, benefit sharing of proceeds of forest exploitation, transportation of forest products, urban tree management services, export permits, import of chainsaws and sawmills, registration of timber and wood product enterprises, and also established a Conservation Trust Fund (GOSL, 2010). Till date, most of these reforms document remain white elephant agreements on shelves of senior government authorities with little or no intention of enforcing them fully in the near future. Despite the efforts of Governments, several million hectares of forestlands are converted to non-forest land uses without prior authorization each year in West Africa. Millions of additional hectares of forests are exploited unsustainably and thus become degraded, often beyond their capacities to fulfill their ecological, economic and social functions in the long run. Increasingly, a significant proportion of the world's timber, as well as non-timber forest products (NTFPs), are coming from forests that have been or are being degraded (FAO, 2009).

Table 2: Direct cause of forest and land degradation in Sierra Leone (Source: SLBTFA (2007)

Causes	Low (a)	Medium (b)	High (c)	Critical (d)	Total (C&D)	Ranking
Logging	24	25	125	25	199	1
Mining	20	47	87	19	173	3
Wild bush fire	40	35	34	3	112	9
Expansion of settlements	19	39	65	23	246	6
Shifting cultivation	13	59	60	4	136	7
Refugee camp activities	25	38	57	2	128	8
Fire wood collection	8	45	101	28	182	2
Infrastructure	41	50	18	0	109	10
Charcoal production	20	43	95	14	172	4
Pollution (waste disposal)	21	42	42	3	108	11
Tobacco growing	14	7	5	1	27	14
Tree crop plantation	55	40	47	5	147	5
Animal grazing	1	0	0	0	1	14

The need to conserve the remaining Forest of Sierra Leone

In 2014, the global forest watch reported that Sierra Leone has 208 million tons of carbon stocks in living forest biomass alone. The forestry sector contributed USD$ 225.1 million to the economy in 2011 which is approximately 7.9% of the GDP of the country (Global forest watch, 2014).Since forest is priceless heritage, human survival and sustainable economic development depend fundamentally on proper maintenance of natural resources. These resources include trees, shrubs, ferns, soil, laterite, streams, rivers, mushrooms raffia, fruits, seeds, gum, resins, honey vegetables, and wildlife including fishes, birds, and snails. As a result of these benefits, governments should be interested in the management of forest resources in their domain to provide the citizens with forest goods and services (Udo, 2001).Sierra Leone's rainforests, mangroves and savannah forests use to host a high level of endemic and (internationally) rare and threatened species. The Upper Guinean Forest ecosystem is listed on the World Wildlife Fund's (WWF) "Global 200" list of critical regions for conservation and is included as one of Conservation International's 34 global biodiversity hotspots (Brown and Crawford, 2012).Recent studies have revealed that forest products, to a large extent, form an integral part of rural food security strategies as dependence of wild fruits is common and could be linked to poverty (FAO, 1989, FRS, 1998). The FRS (1998) report, observed that millions of low income or land less rural household depends on the harvesting, processing and sale of forest products as their main and sometime only

source of cash income to carry them through during the lean or difficult periods of the agricultural cycle (Dwumfour, 2006). FAO (1990) had reported of worsening situation of degradation of tropical forests in West Africa in which Sierra Leone is a component.In Sierra Leone, scale of public and private plantation establishment is very low. Most plantations are in the public sector and the management has been very poor due to non-budgetary allocations. Where valuable plantation such as teak (*Tectonagrandis,Pinuscarabeae and Gmelinaarborea*) exists they are improperly harvested for overseas market at giveaway pricesOmiyale (2008). UNDP (2015) reports stated that fluctuations in rainfall in Sierra Leone has been aggravated by loss in vegetation cover from anthropogenic activities (slash and burn, charcoal production, excessive firewood collection, illegal timber logging among others).

The country has 2,090 known species of higher plants, 147 mammals, 626 birds, 67 reptiles, 35 amphibians, and 99 fish species FAO (2005).If the above biodiversity is to survive for the next decade, then urgent forest management policies need to be put in place and implemented. Several factors, including hydrological conditions, such as the frequency and duration of flooding, depth of the water level, soil type, and physiography determine the vegetation and composition of plant communities (Asamoah*et al*., 2012).

The figure below shows the devastated nature of the forest resources in Sierra Leone. According to the figure, 55% of the country land area is in a secondary growth farm bush status and it is yet threatened by anthropogenic activities.

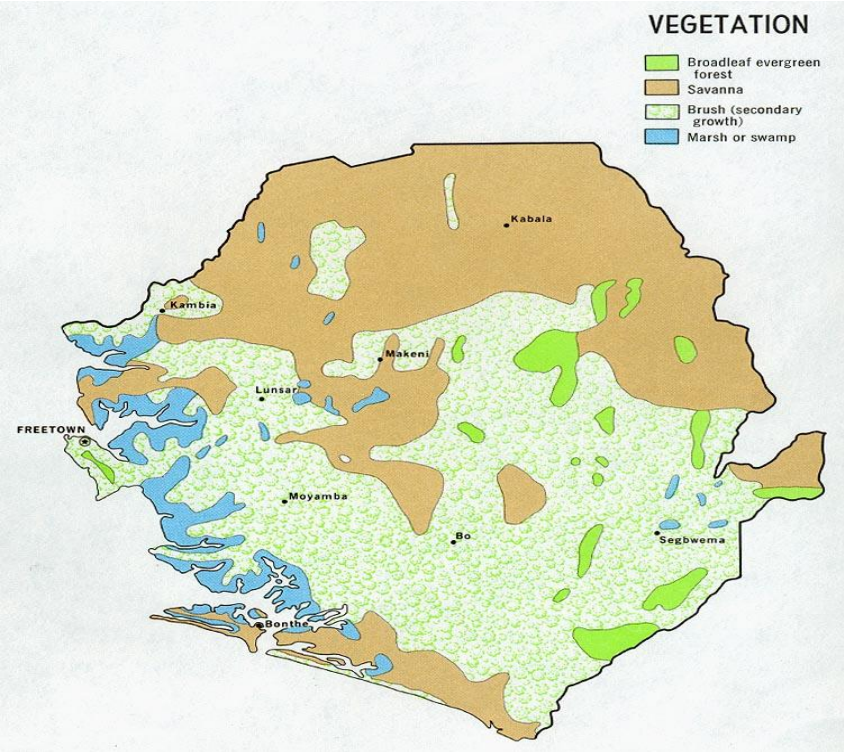

Figure 3: Sierra Leone Vegetation zones (Source: University of Texas)

Conclusion

With the current impacts of climate change, population growth, technological advancement and the demand for better standard of living, the remaining forest of Sierra Leone will not last for a decade if proper management policies are not put in place and implemented urgently. Sierra Leone is endowed with natural resources such as forest, rivers, wetlands, rich in biodiversity especially forest that the rural poor depends on as a safety-net for food, services and income, but the major problem is lack of expert knowledge to help in the achievement of one of the millennium development goals connected with management of our natural resources on a sustainable basis. Due to the drastic decline in mature forest cover and the continual pressure of population growth and rudimentary farming techniques practiced, the status of the forest resources in Sierra Leone is considered at risk. Shifting cultivation, logging, fuel wood and charcoal production, infrastructural development, poverty, wildlife and mining remain the major threats to forests in Sierra Leone. Inadequate training and attitude of both senior and junior forestry staff within the country is greatly contributing to the current status of our forests.At the same time, global climate change is having a major effect on forest ecology, while the drivers of deforestation and degradation, many of which lie outside the forest sector, are intensifying in their effects, with the pressures of population growth and consequent anthropogenic activities in and around the forests in the West African sub-region.While the forest resources serve practically all people, animals and plants on the continent, it is mainly people that destroy and degrade these resources, with the main drivers of deforestation and forest degradation in Africa being farmers at both small holder and large scale (intensive) levels, and including livestock husbandry (AFF, 2015).

The way forward

- A well-managed tropical forest is a constantly self-renewing resource. It produces many thousands of benefits among which are high quality timber, poles, rattan and rubber, fuel wood, charcoal, fruits, nuts, minor products of high economic value such as dyes and medicines.
- For long term forest resource sustainability, the government should incorporate into school syllabus and university programs forestry disciplines and encourage every citizen to protect and plant more trees.
- With the alarming rate of forest destruction in the country, the Government has to put in place a robust forest protection measures with heavy penalty regardless of social, political and financial status of defaulters.
- For a better national awareness raising on the importance of forests, the government, local communities and all educational institutions in Sierra Leone should carry out a sensitization campaign and encourage mass reforestation and afforestationprogrammesat community level.

- Forestry Division should be made a Ministry on its own with the number of staffs increased especially forest guards, patrol men and rangers for the effective monitoring and protection of the remaining forest areas throughout the country.
- It will be vital to plan, encourage and carry out large scale enrichment planting of economic plant species in degraded forest within the country.
- More forest base research institutions should be established in order to conduct research, train both the middle man power and professionals in forest resource protection, conservation and management.

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Chemical insecticides and their hazardous impact

P.B. Meshram
Forest Entomology Division
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Jabalpur -482 021, Madhya Pradesh

Introduction

The term pesticide covers a wide range of compounds including insecticides, fungicides, herbicides, rodenticides, molluscicides, nematicides, plant growth regulators and others. Among these, organochlorine (OC) insecticides, used successfully in controlling a number of diseases, such as malaria and typhus, were banned or restricted after the 1960s in most of the technologically advanced countries. The introduction of other synthetic insecticides – organophosphate (OP) insecticides in the 1960s, carbamates in 1970s and pyrethroids in 1980s and the introduction of herbicides and fungicides in the 1970s–1980s contributed greatly to pest control and agricultural output. Ideally a pesticide must be lethal to the targeted pests, but not to non-target species, including man. Unfortunately, this is not the case, so the controversy of use and abuse of pesticides has surfaced. The rampant use of these chemicals, under the adage, 'if little is good, a lot more will be better' has played havoc with human and other life forms.

Production and usage of pesticides in India

The production of pesticides started in India in 1952 with the establishment of a plant for the production of BHC near Calcutta, and India is now the second largest manufacturer of pesticides in Asia after China and ranks twelfth globally (Mathur, 1999). There has been a steady growth in the production of technical grade pesticides in India, from 5,000 metric tons in 1958 to 102,240 metric tons in 1998. In 1996–97 the demand for pesticides in terms of value was estimated to be around Rs. 22 billion, which is about 2% of the total world market. The pattern of pesticide usage in India is different from that for the world in general. The use of herbicides and fungicides is correspondingly less heavy. The main use of pesticides in India is for cotton crops (45%), followed by paddy and wheat.

Benefits of pesticides

The primary benefits are the consequences of the pesticides' effects – the direct gains expected from their use. For example the effect of killing caterpillars feeding on the crop brings the primary benefit of higher yields and better quality of cabbage. The three main effects result in 26 primary benefits ranging from protection of recreational turf to saved human lives. The secondary benefits are the less immediate or less obvious benefits that result from the primary benefits. They may be subtle, less intuitively obvious, or of longer term. It follows that for secondary benefits it is therefore more difficult to establish cause and effect, but nevertheless they can be

powerful justifications for pesticide use. For example the higher cabbage yield might bring additional revenue that could be put towards children's education or medical care, leading to a healthier, better educated population. There are various secondary benefits identified, ranging from fitter people to conserved biodiversity.

Improving productivity

Tremendous benefits have been derived from the use of pesticides in forestry, public health and the domestic sphere and of course, in agriculture, a sector upon which the Indian economy is largely dependent. Food grain production, which stood at a mere 50 million tons in 1948–49, had increased almost fourfold to 198 million tons by the end of 1996–97 from an estimated 169 million hectares of permanently cropped land. This result has been achieved by the use of high-yield varieties of seeds, advanced irrigation technologies and agricultural chemicals. Similarly outputs and productivity have increased dramatically in most countries, for example wheat yields in the United Kingdom, corn yields in the USA. Increases in productivity have been due to several factors including use of fertilizer, better varieties and use of machinery. Pesticides have been an integral part of the process by reducing losses from the weeds, diseases and insect pests that can markedly reduce the amount of harvestable produce. Moreover, in the environment most pesticides undergo photochemical transformation to produce metabolites which are relatively non-toxic to both human beings and the environment.

Protection of crop losses/yield reduction

In medium land, rice even under puddle conditions during the critical period warranted an effective and economic weed control practice to prevent reduction in rice yield due to weeds that ranged from 28 to 48%, based on comparisons that included control (weedy) plots (Behera and Singh, 1999). Weeds reduce yield of dry land crops by 37–79%. Severe infestation of weeds, particularly in the early stage of crop establishment, ultimately accounts for a yield reduction of 40%. Herbicides provided both an economic and labour benefit.

Vector disease control

Vector-borne diseases are most effectively tackled by killing the vectors. Insecticides are often the only practical way to control the insects that spread deadly diseases such as malaria, resulting in an estimated 5000 deaths each day (Ross, 2005). In 2004, Bhatia wrote that malaria is one of the leading causes of morbidity and mortality in the developing world and a major public health problem in India. Disease control strategies are crucially important also for livestock.

Quality of food

In countries of the first world, it has been observed that a diet containing fresh fruit and vegetables far outweigh potential risks from eating very low residues of pesticides in crops. Increasing evidence shows that eating fruit and vegetables regularly reduces the risk of many cancers, high blood pressure, heart disease, diabetes, stroke, and other chronic diseases. discussed the nutritional properties of apples and blueberries in the US diet and concluded that their high concentrations of antioxidants act as protectants against cancer and heart

disease. Lewis attributed doubling in wild blueberry production and subsequent increases in consumption chiefly to herbicide use that improved weed control.

Other areas – transport, sport complex, building

The transport sector makes extensive use of pesticides, particularly herbicides. Herbicides and insecticides are used to maintain the turf on sports pitches, cricket grounds and golf courses. Insecticides protect buildings and other wooden structures from damage by termites and wood boring insects.

Hazards of pesticides:

Direct impact on humans

If the credits of pesticides include enhanced economic potential in terms of increased production of food and fibre, and amelioration of vector-borne diseases, then their debits have resulted in serious health implications to man and his environment. There is now overwhelming evidence that some of these chemicals do pose a potential risk to humans and other life forms and unwanted side effects to the environment (Jeyaratnam, 1981). No segment of the population is completely protected against exposure to pesticides and the potentially serious health effects, though a disproportionate burden is shouldered by the people of developing countries and by high risk groups in each country (WHO, 1990). The world-wide deaths and chronic diseases due to pesticide poisoning number about 1 million per year. The high risk groups exposed to pesticides include production workers, formulators, sprayers, mixers, loaders and agricultural farm workers. During manufacture and formulation, the possibility of hazards may be higher because the processes involved are not risk free. In industrial settings, workers are at increased risk since they handle various toxic chemicals including pesticides, raw materials, toxic solvents and inert carriers. OC compounds could pollute the tissues of virtually every life form on the earth, the air, the lakes and the oceans, the fishes that live in them and the birds that feed on the fishes (Hurley *et al*., 1998). The US National Academy of Sciences stated that the DDT metabolite DDE causes eggshell thinning and that the bald eagle population in the United States declined primarily because of exposure to DDT and its metabolites. Certain environmental chemicals, including pesticides termed as endocrine disruptors, are known to elicit their adverse effects by mimicking or antagonising natural hormones in the body and it has been postulated that their long-term, low-dose exposure is increasingly linked to human health effects such as immune suppression, hormone disruption, diminished intelligence, reproductive abnormalities and cancer.

Impact through food commodities

For determining the extent of pesticide contamination in the food stuffs, programs entitled 'Monitoring of Pesticide Residues in Products of Plant Origin in the European Union' started to be established in the European Union since 1996. In 1996, seven pesticides (acephate, chlopyriphos, chlopyriphos-methyl, methamidophos, iprodione, procymidone and chlorothalonil) and two groups of pesticides (benomyl group and maneb group, i.e. dithiocarbamates) were analysed in apples, tomatoes, lettuce, strawberries and grapes.

An average of about 9 700 samples has been analysed for each pesticide or pesticide group. For each pesticide or pesticide group, 5.2% of the samples were found to contain residues and 0.31% had residues higher than the respective MRL for that specific pesticide. Lettuce was the crop with the highest number of positive results, with residue levels exceeding the MRLs more frequently than in any of the other crops investigated. The highest value found in 1996 was for a compound of the maneb group in lettuce which corresponded to a mancozeb residue of 118 mg/kg. In 1997, 13 pesticides (acephate, carbendazin, chlorothalonil, chlopyriphos, DDT, diazinon, endosulfan, methamidophos, iprodione, metalaxyl, methidathion, thiabendazole, and triazophos) were assessed in five commodities (mandarins, pears, bananas, beans, and potatoes).

Impact on environment

Pesticides can contaminate soil, water, turf, and other vegetation. In addition to killing insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish, beneficial insects, and non-target plants. Insecticides are generally the most acutely toxic class of pesticides, but herbicides can also pose risks to non-target organisms.

Surface water contamination

Pesticides can reach surface water through runoff from treated plants and soil. Contamination of water by pesticides is widespread. The results of a comprehensive set of studies done by the U.S. Geological Survey (USGS) on major river basins across the country in the early to mid- 90s yielded startling results. More than 90 percent of water and fish samples from all streams contained one, or more often, several pesticides (Kole *et al*.,2001). Pesticides were found in all samples from major rivers with mixed agricultural and urban land use influences and 99 percent of samples of urban streams (Bortleson and Davis, 1987–1995). The USGS also found that concentrations of insecticides in urban streams commonly exceeded guidelines for protection of aquatic life (U.S. Geological Survey, 1999). Twenty-three pesticides were detected in waterways in the Puget Sound Basin, including 17 herbicides. According to USGS, more pesticides were detected in urban streams than in agricultural streams (US Department of the Interior, 1995). The herbicides 2,4-D, diuron, and prometon, and the insecticides chlorpyrifos and diazinon, all commonly used by urban homeowners and school districts, were among the 21 pesticides detected most often in surface and ground water across the nation.

Ground water contamination

Groundwater pollution due to pesticides is a worldwide problem. According to the USGS, at least 143 different pesticides and 21 transformation products have been found in ground water, including pesticides from every major chemical class. Over the past two decades, detections have been found in the ground water of more than 43 states. During one survey in India, 58% of drinking water samples drawn from various hand pumps and wells around Bhopal were contaminated with Organo Chlorine pesticides above the EPA standards. Once ground water is polluted with toxic chemicals, it may take many years for the contamination to dissipate or be cleaned up.

Cleanup may also be very costly and complex, if not impossible.

Soil contamination

A large number of transformation products (TPs) from a wide range of pesticides have been documented (Barcelo and Hennion, 1997). Not many of all possible pesticide TPs have been monitored in soil, showing that there is a pressing need for more studies in this field. Persistency and movement of these pesticides and their TPs are determined by some parameters, such as water solubility, soil-sorption constant. Pesticides and TPs could be grouped into:(a) Hydrophobic, persistent, and bioaccumulable pesticides that are strongly bound to soil. Pesticides that exhibit such behavior include the organochlorine DDT, endosulfan, endrin, heptachlor, lindane and their TPs. Most of them are now banned in agriculture but their residues are still present. (b) Polar pesticides are represented mainly by herbicides but they include also carbamates, fungicides and some organophosphorus insecticide TPs. They can be moved from soil by runoff and leaching, thereby constituting a problem for the supply of drinking water to the population. The most researched pesticide TPs in soil are undoubtedly those from herbicides.

Effect on soil fertility (beneficial soil microorganisms)

Heavy treatment of soil with pesticides can cause populations of beneficial soil microorganisms to decline. According to the soil scientist Dr. Elaine Ingham, "If we lose both bacteria and fungi, then the soil degrades. Overuse of chemical fertilizers and pesticides have effects on the soil organisms that are similar to human overuse of antibiotics. Indiscriminate use of chemicals might work for a few years, but after awhile, there aren't enough beneficial soil organisms to hold onto the nutrients" (Savonen, 1997). For example, plants depend on a variety of soil microorganisms to transform atmospheric nitrogen into nitrates, which plants can use. Common landscape herbicides disrupt this process: triclopyr inhibits soil bacteria that transform ammonia into nitrite glyphosate reduces the growth and activity of free-living nitrogen-fixing bacteria in soil. and 2,4-D reduces nitrogen fixation by the bacteria that live on the roots of bean plants reduces the growth and activity of nitrogen-fixing blue-green algae and inhibits the transformation of ammonia into nitrates by soil bacteria mycorrhizal fungi grow with the roots of many plants and aid in nutrient uptake.

Contamination of air, soil, and non-target vegetation

Pesticide sprays can directly hit non-target vegetation, or can drift or volatilize from the treated area and contaminate air, soil, and non-target plants. Some pesticide drift occurs during every application, even from ground equipment. Drift can account for a loss of 2 to 25% of the chemical being applied, which can spread over a distance of a few yards to several hundred miles. As much as 80–90% of an applied pesticide can be volatilised within a few days of application. Despite the fact that only limited research has been done on the topic, studies consistently find pesticide residues in air. Nearly every pesticide investigated has been detected in rain, air, fog, or snow across the nation at different times of the year (U.S. Geological Survey, 1999). Many

pesticides have been detected in air at more than half the sites sampled nationwide. Herbicides are designed to kill plants, so it is not surprising that they can injure or kill desirable species if they are applied directly to such plants, or if they drift or volatilise onto them. Many ester-formulation herbicides have been shown to volatilise off treated plants with vapors sufficient to cause severe damage to other plants.

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World Network of Biosphere Reserves

N. Roychoudhury, Ruby Sharma and Rajesh Kumar Mishra
Tropical Forest Research Institute
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Jabalpur – 482021, Madhya Pradesh, India

The article deals with the biosphere reserves in World Network of Biosphere Reserves (WNBR). Currently, there are 669 biosphere reserves in 120 countries, including 16 transboundary sites in WNBR. Vision and mission statements for the WNBR within the Man and the Biosphere (MAB) programme are also highlighted.

Introduction

The UNESCO World Network of Biosphere Reserves (WNBR) covers internationally designated protected areas, each known as biosphere reserves, that are meant to demonstrate a balanced relationship between people and nature (e.g. encourage sustainable development) (https://en.wikipedia.org/wiki/World_Network_of_Biosphere_Reserves).

Biosphere reserves are sites of excellence for testing innovative approaches to sustainable development where scientific knowledge and governance modalities are combined to reduce biodiversity loss, improve livelihoods and enhance social, economic and cultural conditions for environmental sustainability.

Of special importance are the involvement of local communities and the participation of all the interested stakeholders in the planning and the management of entire area. Biosphere reserves seek to integrate the three main functions: Conservation of biodiversity and cultural diversity, economic development that is socio-culturally and environmentally sustainable and logistic support for research monitoring, environmental education and training. Each biosphere is divided in three main zones: core zone for conservation, monitoring and non-destructive research, buffer zone surrounding or adjoining core area for activities compatible with sound ecological practices and transition zone for activities where stakeholders work together to sustainably manage the area's resources. Biosphere reserve serve as learning and demonstration sites within the frame work on sustainable development. Biosphere reserve offer valuable contribution to the achievement of Millenium Development Goals (MDGs) in particular on environmental sustainability. Within the World Network of Biosphere Reserves (WNBR), information, experiences and ideas are shared and exchanged at sub-regional, regional and international level. Currently, there are 669 biosphere reserves in 120 countries, including 16 transboundary sites in WNBR (Table 1) (https://en.wikipedia.org/wiki/World_Network_of_ Biosphere_Reserves).

Table 1: Biosphere reserves by regions

Regions	Number of biosphere reserves	Countries
Africa	70	28
Arab States	30	11
Asia and the Pacific	142	24
Europe and the North America	302	36
Latin America and the Caribbean	125	21
Total	**669**	**120***

*Include 16 transboundary sites.

Vision statement for the World Network of Biosphere Reserves (WNBR) within the Man and the Biosphere (MAB) programme

The World Network of Biosphere Reserves of the Man and Biosphere Programme consists of a dynamic and interactive net work of sites of excellence (https://www.bfn.de/fileadmin/MDB/documents/themen/gebietsschutz/Madrid_Action_Plan_en.pdf). It fosters integration of people and nature for sustainable development through participatory dialogue, knowledge sharing, poverty reduction and human well-being improvements, respect for cultural values and society's ability to cope with change, thus contributing to the Millennium Development Goals (MDGs). Accordingly, the WNBR is one of the main international tools to develop and implement sustainable development approaches in a wide array of contexts.

Mission statement for the World Network of Biosphere Reserves (WNBR) within the Man and the Biosphere (MAB) programme

To ensure environmental, economic and social including cultural and spiritual sustainability through (https://www.bfn.de/file admin/ MDB/documents/themen/gebietsschutz/Madrid_Action_Plan_en. pdf): development and coordination of a worldwide network of places acting as demonstration areas and learning sites with the aim of maintaining and developing ecological and cultural diversity and securing ecosystem services for human well-being; development and integration of knowledge including science for advancing understanding of interactions between people and the rest of nature; building global capacity for the management of complex socio-ecological systems particularly through encouraging greater dialogue at the science policy interface, environmental education and multi-media outreach to the wider community.

उन्नत रोपणी एवं उपकरण

ममता पुरोहित, एस. एल. मीणा एवं राजेश कुमार मिश्रा

उष्णकटिबंधीय वन अनुसंधान संस्थान

(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)

मण्डला रोड, ज़बलपुर – 482021 (म.प्र.)

पर्यावरणीय समस्याओं, घटती उपजाऊ भूमि एवं विभिन्न वानस्पतिक प्रजातियों कि बढ़ती मांग ने उन्नत रोपणियों, आधुनिक रोपणी उपकरणों एवं तकनीकियों के उपयोग आवश्यक बना दिया है । अन्य व्यवसायों की तरह रोपणी संचालन भी रोजगार का सशक्त माध्यम बनता जा रहा है । जीविका उपार्जन के लिए रोपणी संचालन अशिक्षित, कम पढ़े-लिखे एवं शिक्षित बेरोजगारों के लिए समान रूप से लाभकारी है । महिलाएं भी सफलतापूर्वक रोपणी का संचालन कर सकती हैं । आवश्यकता है रोपणी निर्माण से संबंधित जानकारी प्राप्त करने की, मेहनत की और धैर्य के साथ रोपणी का संचालन करने की । विकसित देशों में उन्नत रोपणियों का निर्माण कार्य सन् 1930 से ही शुरु हो गया था । वहाँ के रोपणी संचालकों की सफलता से प्रेरित होकर हमारे देश की सरकार, कृषि वैज्ञानिकों, वन वैज्ञानिकों, जागरुक किसानों एवं शिक्षित उद्यमियों ने भी उन्नत रोपणियों की उपयोगिता एवं आवश्यकता को समझा परिणामस्वरुप सन् 1980 से हमारे देश में भी उन्नत रोपणियों के निर्माण पर ध्यान दिया जाने लगा । उन्नत रोपणियों में आधुनिक उपकरणों एवं तकनीकियों की सहायता से कम समय, श्रम व लागत में वर्ष भर इच्छित प्रजातियों की मांग के अनुसार पौध तैयार कर उनका संरक्षण एवं विक्रय कर सकते हैं । इन रोपणियों में फूल, फल, साग-सब्जी, औषधीय पौधे व महत्वपूर्ण वन प्रजातियों के पौधे सफलतापूर्वक उगाये व रोपण हेतु तैयार किये जा सकते हैं । वृक्षारोपण हेतु बड़े पैमाने पर इमारती वृक्ष प्रजातियों, ईंधन प्रजातियों, बहुउद्देशीय प्रजातियों आदि की मांग को पूरा करने में इन रोपणियों की अहम भूमिका है । प्रत्येक वर्ष विभिन्न प्रजातियों की मांग को रोपणियों द्वारा सफलतापूर्वक पूरा किया जा रहा है । सरकार द्वारा उन्नत रोपणियों के निर्माण व रोपणी में उपयोग किये जाने वाले उपकरणों हेतु कृषक वर्ग और इच्छित उद्यमियों को प्रोत्साहित किया जा रहा है । पुरानी रोपणियों में जहाँ पॉलीथीन थैलियों में मृदा मिश्रण में बीज बोकर पौधे तैयार किये जाते थे या किये जा रहे हैं उन्हे आधुनिक उपकरणों व तकनीकियों तथा कम्पोस्ट इकाई द्वारा उन्नत रोपणियों में परिवर्तित किया जा रहा है । प्रस्तुत आलेख में रोपणी निर्माण, उपकरण व तकनीकियों तथा कम्पोस्ट इकाई से संबंधित जानकारियों को लिपिबद्ध किया गया है जिससे विभिन्न प्रकार की जलवायु वाले क्षेत्रों में ऊगने व वृद्धि करने वाली महत्वपूर्ण प्रजातियों को मांग के अनुसार इच्छित संख्या में तैयार किया जा सके ।

रोपणी

रोपणी वह स्थान है जहाँ वृक्षारोपण हेतु पौधों को उगाया व तैयार किया जाता है।

किसान रोपणी

किसान की भूमि का वह भाग जहाँ किसान अपनी जरुरतों के पौधे स्वयं उगाकर वृक्षारोपण हेतु तैयार करता है।

रोपणी निर्माण हेतु जमीन की तैयारी

रोपणी निर्माण हेतु उपलब्ध भूमि को आवश्यकतानुसार पानी का छिड़काव कर हल/ट्रेक्टर आदि से एक फुट गहराई तक जुताई कर देना चाहिए जिससे मिट्टी अलट-पलट कर भुरभुरी, एकरस व धूप से उपचारित हो जाये तथा घांस/खरपतवार आदि जड़ से उखड़ जायें। रोपणी के लिए दोमट मिट्टी सबसे अच्छी होती है। यदि उपलब्ध भूमि की मिट्टी अच्छी नहीं है तो किसी तालाब या नदी के पास की मिट्टी का उपयोग करना चाहिए। रोपणी निर्माण वाली जगह अन्य भूमि से ऊँची या उसी के समतल होनी चाहिए। रोपणी का निर्माण ऐसी जगह पर करना चाहिए जहाँ रोपणी पर सूर्य की किरणें पर्याप्त रूप से पड़ें

चित्र 1 क्यारियाँ

तथा रोपणी में पानी के निकास की उचित व्यवस्था होना चाहिए। गर्मी कि दिनों में भी पानी की उपलब्धता बनी रहनी चाहिए। रोपणी में क्यारियों की माप 10 मीटर x 1 मीटर तथा एक क्यारी से दूसरी क्यारी 0.5 मीटर की दूरी पर बनाना चाहिए (चित्र 1) जिससे सिंचाई, निंदाई-गुड़ाई व अन्य सम्बंधित कार्य करने में सुविधा हो। पौधे की किस्म के अनुसार क्यारियाँ जमीन की सतह से लगभग 0.5 फुट ऊँची, नीची या सतह के समतल बनाना चाहिए। रोपणी में तैयार किये गये छोटे-छोटे पौधों को तेज एवं सीधी पड़ने वाली धूप से बचाने के लिए रोपणी के आस-पास कुछ वृक्ष होना चाहिए अथवा छाया की व्यवस्था होना चाहिए।

बीज संग्रहण

चित्र 2 स्वस्थ्य एवं खराब बीज

उन्नत पौध तैयार करने के लिए यह आवश्यक है कि बीज एकत्रित करने हेतु ऐसे वृक्षों का चुनाव किया जाये जिनका तना सीधा हो, छत्र विकसित हो, वृक्ष कीट व रोग रहित हों तथा वृक्ष की आयु न बहुत अधिक हो न बहुत कम हो। एकत्रित फलों को पर्याप्त रूप से सुखाकर बीजों को निकालना चाहिए। फलों से निकालने के पश्चात, बीज की प्रकृति के अनुसार पुनः धूप या छाँव में सुखाना चाहिए। भंडारण या बुआई से पूर्व स्वस्थ्य बीजों को टेढ़े-मेढ़े,

कम विकसित व अपरिपक्व बीजों से अलग कर लेना चाहिए (चित्र 2)।

बीजों का भंडारण

पर्याप्त रूप से सूखे बीजों को प्लास्टिक के वायुरोधी डिब्बों, पॉलीथीन की थैलियों, सूती कपड़े की थैलियों, जूट की बोरियों या गैल्वेनाइज्ड टीन की टंकियों में रखना चाहिए (चित 3)। पहचान के लिए प्रजाति का नाम, बीज एकत्रीकरणकर्त्ता का

चित्र 3 बीजों का भंडारण

नाम, एकत्रीकरण स्थल, तारीख आदि की जानकारी वाला प्रपत्र भरकर पात्र के अंदर और यथासंभव ऊपर चिपका देना चाहिए। इन पात्रों को भंडार कक्ष में रखना चाहिए। भंडार कक्ष की दीवारें व फर्श सीलन रहित हो, चूहों व दीमकों का प्रकोप ना हो व दीवारें चूने से पुती होना चाहिए। 100 किलोग्राम चूने में 15 किलोग्राम फिटकरी के हिसाब से पुताई करना चाहिए। पुताई सूख जाने पर फर्श से 2 मीटर की ऊँचाई तक कोलतार पोतना चाहिए। भंडारण से पहले भंडार कक्ष की साफ-सफाई कर कूड़ा-करकट जला देना चाहिए। प्लास्टिक के डिब्बे, थैलियों, बोरियों, टंकियों आदि को दीवार से 2 फुट की दूरी व फर्श से 6 इंच की ऊँचाई पर भूसा , बल्ली व चटाई पर रखना चाहिए।

बीज उपचार

शीघ्र व एक साथ अंकुरण के लिए बुवाई पूर्व बीजों की प्रकृति के अनुसार बीजों को उपचारित करना चाहिए जैसे ठंडे व गरम पानी में भिन्न-भिन्न समय के लिए डुबाकर रखना, खुरदुरी सतह या रेत पेपर पर बीजों को घिसना, सल्फ्यूरिक अम्ल, हाइड्रोक्लोरिक अम्ल आदि रसायनों एवं जिब्रेलिन, इंडोल एसिटिक एसिड, इंडोल ब्यूटिरिक एसिड आदि हार्मोन्स के भिन्न-भिन्न सांद्रता वाले घोलों में 5, 10, 15, 20 मिनट या अधिक समय तक उपचारित करना चाहिए। उपचार पश्चात बीजों को पानी से अच्छी तरह धोकर बोना चाहिए।

कटिंग्स प्राप्त करना

कटिंग्स से पौध तैयार करने के लिए स्वस्थ्य वृक्ष कि शाखाओं से 10 से 22 से.मी. लम्बी तथा 1.5 या 5 से.मी. माप की गोलाई वाली कटिंग्स प्राप्त की जाती है। कटिंग्स प्राप्त करने से पहले शाखाओं को पत्ती विहीन कर दिया जाता है । काटी गई शाखाओं से तेज धारदार औजार से कटिंग्स काटी जाती हैं।

पौधों की देखभाल एवं सुरक्षा

पौधों की उत्तम वृद्धि के लिए समय-समय पर आवश्यकतानुसार सिंचाई, निंदाई-गुड़ाई तथा स्थान परिवर्तन करते रहना चाहिए। कीड़ों, फफूंद व अन्य रोगों से बचाव हेतु विशेषज्ञों की सलाह अनुसार उपचार करना चाहिए।

आवश्यक सामग्री

गोबर की पकी खाद, बी.एच.सी. पाउडर, प्लास्टिक बाल्टियाँ व मग, गैल्वेनाइज्ड शीट की टंकियाँ, पॉलीथीन की थैलियाँ, सूती कपड़े की

थैलियाँ, जूट की बोरियाँ, सूखी घांस, भूसा, चूना, फिटकरी, कोलतार, बल्ली, चटाई, रस्सी आदि।

आवश्यक औजार

रोपणी संचालन में गैंती, फावड़ा, हथौड़ी, सब्बल, कुल्हाड़ी, तगाड़ी, तराजू, कैंची, हंसिया, खुरपी, सिंचाई करनेवाला झारा, दवाई छिड़कने हेतु स्प्रेयर, चाकू, बड़ा छन्ना एवं चलनियाँ, लकड़ी की खूँटियाँ, तख्तियाँ, पेंट, रंग और ब्रश आदि तथा 30 मीटर माप वाला टेप हमेशा उपलब्ध रहना चाहिए।

आवश्यक संरचना

कम्पोस्ट इकाई (कार्बनिक खाद बनानेवाली संरचना)

इस संरचना में रूट ट्रेनर/पॉलीथीन थैलियों में भरने के लिए मृदा मिश्रण (पोटिंग मिक्चर) हेतु कम्पोस्ट तैयार किया जाता है। कटर मशीन (चित्र 4) तथा आवश्यकतानुसार 2.5 या 4 हार्सपावर की मोटर की सहायता से घांस, खरपतवार तथा अन्य कूड़ा-करकट को छोटे-छोटे टुकड़ों में काटा जाता है। छोटे-छोटे टुकड़े कम समय में आसानी से विघटित हो जाते हैं। इन टुकड़ों को कम्पोस्ट इकाई के

चित्र 4 कटर मशीन

कमरों में भरा जाता है। कमरों की बाहरी एवं भीतरी दीवारें चौकोर छिद्रयुक्त (चित्र 4 एवं 5) होती हैं, छिद्रों की सहायता से कम्पोस्ट बनाने वाले जीवाणुओं को शुद्ध वायु प्राप्त होती रहती है। यदि रोपणी मालिक के पास कम्पोस्ट इकाई उपलब्ध नहीं है तो वह काटे गये टुकड़ों को पेड़ों की छांव में जहाँ पर कुछ मात्रा में सूर्यप्रकाश भी आता हो वहाँ पर इकट्ठा कर कम्पोस्ट बना सकता है। कम्पोस्ट इकाई के कमरे में काटे गये टुकड़ों को पेड़ों की टहनियों पर इस प्रकार जमाते हैं कि यदि ढेर के निचले भाग (आधार) की परिधी 5 मीटर है तो ऊपरी भाग की परिधी 1 मीटर हो जिससे ढेर में आसानी से वायु संचार होता रहे और

चित्र 5 कम्पोस्ट

विघटन जल्दी हो जाए (चित्र 5)। कम्पोस्ट बनाने के लिए ढेरे को समय-समय पर 4, 8, 12, 18, 24, 30 दिन के अन्तराल पर अलटते-पलटते रहते हैं और पानी की सिंचाई करते रहते हैं। पानी की मात्रा अधिक नहीं होनी चाहिए क्योंकि अधिक पानी डालने पर पानी बहने लगेगा और पोषक तत्व पानी के साथ बहकर नष्ट हो जायेंगे तथा कम्पोस्ट में पोषक तत्वों का प्रतिशत कम रहेगा। कम्पोस्ट बनाने में तापक्रम का विशेष ध्यान रखा जाता है क्योंकि 50 डिग्री सेल्सियस से अधिक तापक्रम बढ़ने पर थर्मोफिलिक जीवाणु मरने लगते हैं और खाद बनाने की प्रक्रिया धीमी पड़ जाती है। अतः

कम्पोस्ट के ढेर का तापक्रम 50 डिग्री सेल्सियस से अधिक नहीं बढ़ना चाहिए। प्रायः खाद बनने में 45 से 60 दिनों का समय लगता है।

उन्नत पौध प्राप्त करने हेतु आवश्यक उपकरण

बुआई उपकरण

बेड रोलर

यह लोहे की बनी संरचना है जिसका व्यास 15 से.मी. तथा लम्बाई 1 मीटर होती है। इसे चलाने के लिए मध्य में लोहे की 1 मीटर लम्बी छड़ को फिक्स किया जाता है। इसका उपयोग रोपणी में क्यारियों को तैयार करने में किया जाता है।

ड्रिल मार्कर

इसका उपयोग क्यारियों में बीजों को बोने के लिए उपयोग में लाया जाता है।

बेड मार्कर

यह संरचना लोहे के तीन चक्कों से बनी हुई होती है। चक्कों का व्यास 60 से. मी. तक होता है। तीनों

चित्र 6 बेड मार्कर

चक्कों को आपस में चित्रानुसार बेल्डिंग करके जोड़ दिया जाता है। इसके ऊपर लगी लोहे की पट्टियों पर नुकीले खीलों को बेल्डिंग करके जोड़ा जाता है। खीलों की लम्बाई 10 से. मी. होती है तथा आपस में दूरी 10 से.मी. या 15 से.मी. रखते हैं (चित्र 6) जिससे बीजों को बोने के लिए आसानी से छिद्र प्राप्त हो सके।

स्क्वेयर मीटर

यह लोहे की छड़ों से बनी 1 x 1 मीटर माप की चौकोर संरचना होती है। इससे बीजों को निश्चित संख्या में बोकर अंकुरण क्षमता, प्रारंभ में नवोदभिदों की बढ़ोतरी के लिए स्थान की आवश्यकता आदि निकालने में मदद मिलती है।

पौधों की उचित बढ़वार हेतु उपकरण

रूट ट्रेनर (जड़ प्रवर्धक)

ये प्लास्टिक के 90 सी सी, 115 सी सी, 300 सी सी माप के की शंक्वाकार पात्र होते हैं। इन्हे भरने के लिए मृदा मिश्रण की कम मात्रा लगती है, जड़ें कुंडलित नहीं हो पातीं तथा पौधों का आसानी तथा सुरक्षरित रूप से परिवहन किया जा सकता है।

लोहे के पलंग

लोहे से बने पलंगों पर जाली लगी होती है। जाली पर पॉलीथीन थैलियाँ रखी जाती हैं। इन पॉलीथीन थैलियों में लगे पौधों की जड़ें पॉलीथीन थैलियों को फाड़कर बाहर आ जाती हैं। प्राकृतिक रूप से एयर प्रूनिंग के द्वारा बाहर आई जड़ों की अतिरिक्त लम्बाई वाली जड़ें समाप्त हो जाती हैं और पौधों की सहायक जड़ों की सँख्या बढ़ने में मदद मिलती है। पलंग का आकार जगह की आवश्यकतानुसार रख सकते हैं। मुख्यतः इन पलंगों का उपयोग चौड़ी पत्तियों वाली प्रजातियों जैसे कुल्लू, सागौन, पलाश, बहेड़ा आदि की पौध तैयार करने के लिए किया जाता है। एक आदर्श पलंग 6

x 1.5 x 1 मीटर आकार का होता है। ये पलंग 3 x 1.5 x 1 मीटर के भी बनाये जाते हैं।

रोपणी की सुरक्षा

चित्र 7 जीवित वृक्षों की बाढ़ (फेन्सिंग)

जानवरों आदि से सुरक्षा के लिए रोपणी के चारों तरफ लोहे के कंटीले तारों या जीवित वृक्ष प्रजातियों जैसे रतनजोत, केतकी, बांस आदि (चित्र 7) की बाड़ (फेन्सिंग) लगाना अतिआवश्यक है। जीवित वृक्ष प्रजातियों की बाड़ लगाने से अतिरिक्त आमदनी भी हो जाती है।

पॉलीथिन थैलियों के उपयोग से हानि

1. इन थैलियों में मृदा मिश्रण की अधिक मात्रा लगती है।
2. पौधे की ऊँचाई अधिक बढ़ जाने से ट्रांसपोर्टेशन के समय पौधे टूटने का खतरा बना रहता है।
3. पॉलीथिन थैलियों को रखने के लिए स्थान अधिक लगता है।
4. सहायक जड़ों की संख्या कम होती है।
5. पौधों की ग्रेडिंग में कठिनाई होती है।
6. जड़ें कुंडलित हो जाती हैं।
7. पौधों के मरने का प्रतिशत अधिक होता है।
8. पॉलीथिन थैलियाँ प्रतिवर्ष खरीदना पड़ती हैं।
9. पर्यावरण को प्रदूषित करती हैं।

घास है मगर खास है

योगेश पारधी, फातिमा शिरीन, अंकुर दहायत एवं नसीर मोहम्मद

उष्णकटिबंधीय वन अनुसंधान संस्थान

(भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय, भारत सरकार)

मण्डला रोड, ज़बलपुर – 482021 (म.प्र.)

ऐतिहासिक आलेखों विज्ञान की विभिन्न शाखाओं जैसे वर्गीकरण विज्ञान, उदविकास जेव भूगोल, पुराभूगर्भ विज्ञान, पुरामौसम विभाग, पुरातत्व इतिहास तथा मानव शास्त्र से प्राप्त तथ्यों का मूल्यांकन करने पर पता चलता है कि विश्व की लगभग सभी सभ्यताएं भोजन एवं चारे के लिए घासो पर ही निर्भर थी ।घास का तात्पर्य केवल गाय भेंस के चारे वाली घास से ही नही है अपितु गेंहू, मक्का, चावल, जौ ज्वार, बाजरा, गन्ना और बांस आदि सभी से है जोकि प्रमुख घासे है तथा जिन पर आज भी जीवन आधारित है। इन घासों में बांस सबसे बडी घास है । प्राचीन मिश्र, ग्रीक व रोम सभ्यताए गेंहू व जौ का प्रयोग किया करती थी ।भारत, चीन व जापान की प्राचीन सभ्ययताए चावल पर तथा पश्चिम गोलार्ध की प्राचीन सभ्यताए मक्का पर निर्भर थीं। सभी घासें वनस्पति जगत के बडे एवं महत्वपूर्ण कुल पोएसी की सदस्य हैं । इस कुल में लगभग 600 वंश तथा 10000 जातियां है जो विश्व के लगभग सभी भागों में पायी जाती है। इस कुल के सदस्य वार्षिक,द्विवार्षिक शाक होते है परन्तु अपवाद के तौर पर बांस आदि वृक्ष का रूप धारण कर लेते हैं। बांस की कुछ प्रजातियों की आयु 100 वर्ष से भी अधिक होती है ।एक बीज पत्री उदगम, झकडा जड पर्व व पर्व संधियों से बना शरीर, पटटे जैसी पत्तियां समान्तर शिराविन्यास पुष्प के सभी चक्र संख्या में तीन या तीन के गुणक में और फल केरियोटिसस यानी फल की दीवार बीज की दीवार से संयुक्त आदि सभी गुणों में समानता इन सभी को घास बनाती है । हालांकि इनमें मूलभूत गुण समान होते हुए भी एक दूसरे के व्यक्तिगत गुण भिन्न होते हैं। गन्ने के तने में अत्याधिक रस होता है जबकि बांस का तना खोखला व रस विहीन होता है। मक्का का तना कोमल, छोटा व कमजोर होता है वही बांस का मजबूत व कठोर तना होता है। घास हर साल फूल देकर वर्षो जीवित रहते है वहीं पर बांस जीवन में एक बार फूल देकर अपने का मार देते हैं। गेंहू व जौ में फूल द्विलिंगी तो मक्का में एकलिंगी होते हैं । सभी घासों में विभिन्न तरह की विभिन्नताएं है परन्तु सभी मूल रूप से घास हैं।

चावल, गेंहूं, मक्का, जौ, ज्चार, धान आदि भाग मुख्य उगाएं जाने वाले अन्न है, वही गन्ना चीनी का सबसे बडा स्त्रोत है । वहीं पर बांस का अपना अलग ही महत्व है यह एक बहुउददेशीय एवं महत्वपूर्ण घास है जो विभिन्न उद्योग व घरेलू उपयोग में काम में लाया

जाता है। वही दूब व कुशा डेस्मोस्टेफिया बाइपिलेटा पूजनीय घास है। घासों का उपयोग सिर्फ भोजन उपलब्ध कराने में ही नही होता है अपितु औषधि निर्माण, जंगली व पालतू पशुओं के चारे में, वातावरण के कार्बन को कम करने में, घर बनाने में, धार्मिक अनुष्ठानों में ईधन के रूप में तथा भूमि के कटाव को रोकने में भी घास का उपयोग होता है। अब हम कुछ प्रमुख घासों के बारे में विस्तार से जाने।

चावल (ओराइजा सटाइवा)

विभिन्न भाषाओं में नामः संस्कृत - धान्य, तन्दुल, हिन्दी- धान चावल, मराठी-तादुलभात, गुजराती चोखा, तमिल आरिशी, तेलगू बिमर, धान्यम।

चावल की दो प्रमुख प्रजातियां एशियाई चावल व अफ्रीकन चावल। एशियाई चावल की खेती सम्पूर्ण विश्व में की जाती है परन्तु अफ्रीकन चावल की खेती सिर्फ अफ्रीका में की जाती है। इसकी खेती का सबसे पहला संदर्भ प्राचीन चीनी साहित्य में मिलता है जिसकी रचना लगभग 2800 ईसा पूर्व की गयी थी। भारतवर्ष में ऋग्वेद, जिसकी रचना 1500 ईसा पूर्व में हुई थी, में धान का वर्णन मिलता है। चावल की खेती यूरोप, अफ्रीका, उष्ण एवं शीतोष्ण एशिया, आस्ट्रेलिया में की जाती है।विश्व में सर्वाधिक चावल चीन में उत्पादित किया जाता है। भारत में सबसे अधिक चावल पश्चिम बंगाल में उत्पादित किया जाता है। भारत मे छत्तीसगढ धान की उत्तम किस्म की पैदावार करने के लिए सम्पूर्ण भारतवर्ष में जाना जाता है। यही वजह है कि छत्तीसगढ धान का कटोरा कहा जाता है। चावल की महत्ता भारतवर्ष में कई शताब्दियों से ज्ञात है इसे धान्य अर्थात मानव जाति को पालने वाला कहां गया है। हडप्पा व मोहनजोदाडों में चावल के साक्ष्य मिले है जिससे यह अनुमान लगाया जा सकता है कि सिन्धु घाटी की सभ्यता के लोग भी चावल का उपयोग भोजन के रूप में करते थे। चावल का उपयोग सिर्फ खाने में ही नही अपितु औषधियों, सौन्दर्य प्रसाधन, कलात्मक सामग्री निर्माण एवं कई धार्मिक व वैवाहिक अनुष्ठानों में किया जाता है।

चावल के 100 ग्राम दानों से 361 केलोरी उर्जा प्राप्त होती है। चावल के 100 ग्राम दानों में कार्बोहाईड्रेट्र प्रोटीन, वसा, रेशे खनिज तत्व पाये जाते हें।

धान के उपर का छिलका निकालकर इसे गर्म पानी में उबालकर या भाप से पकाकर खाने के काम में लिया जाता है। धान के छिलके को भूसी कहा जाता है जिससे मशीन में डालकर इसका तेल निकाला जाता है इस तेल का इस्तेमाल खाने बनाने में वसीय तेल के रूप में होता है। धान की भूसी जलाने के अतिरिक्त कागज व गत्ता निर्माण में भी प्रयुक्त की जाती है।

जापान में टोकियो विश्वविद्यालय के इन्स्टीट्यूट आफ मेडिसीन के प्रो तोमोनोरी नोची के नेतृत्व में वैज्ञानिको के एक दल ने आनुवांशिक दृष्टि से परिष्कृत ऐसे चावल का विकास किया है जिसके जरिए हैजा की वैक्सीन मानव शरीर में पहुंचाई जा सकेगी। इस

तरह से विकसित वेक्सीन परम्परागत वेक्सीन की तुलना में काफी सस्ती व प्रभावी होगी क्योंकि वेक्सीन युक्त चावलों का सामान्य ताप पर ही वर्षो तक भंडारण किया जा सकेगा जबकि परम्परागत वेक्सीन को रेफ्रिजरेटर में रखना होता है जो काफी मंहगा साबित होता है इस प्रकार चावल औषधि रूप में भी उपयोग में लाया जा सकता है।

धान की रोपणी करते हुये किसान

साथ ही सुनहरा चावल ऐसा धान है जिसमें बीटा केराटीन बनाने वाला जीन डाला गया है। जो शरीर में पहुंचकर विटामिन ए बनाता है। इस जीव के प्रभाव से धान का रंग सुनहरा हो जाता है इस खोज से यह आशा की जा सकती है कि हमें कुपोषण से लडने में सफलता मिल सकती है।

आयुर्वेद के अनुसार चावल कान्ति बढाने वाला बल कारक, धातुवर्धक, मधुर, स्निग्ध, शीतल, तेज स्वाभाव वाजीकर, मूत्रवर्धक, वायुनाशक, पेचिश नाशक होता है। चावल के धान का प्रयोग सौन्दर्य प्रसाधन एवं अन्य स्वास्थ्यवर्धक पदार्थ बनाने में किया जाता है। चावल का उपयोग लगभग सभी धार्मिक अनुष्ठान में किया जाता है। हिन्दु धर्म में विवाह के अवसर में चावल का विशेष महत्व है।

गेंहू (ट्रिट्रकम वल्गेर)

विभिन्न भाषाओं में नाम हिन्दी गेंहू,मराठी गेंहू, गहूं, गहंग तेलगू-गोधुमालू, कन्नड- गोही, तमिल-गोधुमई, मलयालम-गोदाम्बा भारतीय गेंहू की प्रजाति है। यह प्रजाति मोहनजोदडो की खुदाई में भी प्राप्त किए गए थे। गेंहू का उपयोग विश्व के कोने कोने में भोजन के

रूप में होता है। मेकोरानी गेंहू असिंचित परिस्थितियों के लिए सबसे उपयुक्त होती है। इससे सूजी बनाई जाती है। इसे सख्त गेंहू की उपमा दी गई है ।इमर गेंहू दक्षिण भारत में उगाया जाता है। ट्रिट्रकम वल्गेर वर्तमान में सबसे प्रचलित प्रजाति है। गेंहू के 100 ग्राम दानों से 326.335 केलोरी उर्जा

प्राप्त होती है। गेंहू में ग्लूटिन नामक प्रोटीन अधिक

मात्रा में पाया जाता है साथ ही कार्बोहाइड्रेट, वसा,रेशे में घुलनशील इन विटामिनों का पिसाई के समय हास हो जाता है । क्षेत्रफल और उत्पादन की दोनो दिष्ट से विश्व में धान के बाद गेंहू दूसरी महत्वपूर्ण फसल है । साधारणतया गेंहू में जितनी अधिक प्रोटीन होगी, उतनी ही अधिक मात्रा में ग्लूटेन ही होगी । गेंहू के आटे में उपस्थित प्रोटीन का लगभग 47 प्रतिशत ग्लूटेनिन होता है । गेहूसे रोटी डबलरोटी पूरी बिस्कुट केक नूडल्स इत्यादि भोज्य पदार्थ बनते हैं । बल्कि इसे किण्वीकृत कर बीयर व अन्य पेय पदार्थ तथा तरल ईधन भी प्राप्त किए जाते हैं ।

गेंहू के अनेक उपयोगी उत्पाद

हाटवेल 1967-1971 के अनुसार गेंहू के दानों का

उपयोग कैंसर, पैर का गोखरू, गॉठ, मस्सा तथा नखव्रण में किया जाता है । *डयूक एवं वेन 1981* के अनुसार गेंहू का उपयोग पारम्परिक औषधियों जैसे जलने पर, दस्त, पेचिश,इकेमोसिस, एपिस्टेक्सिस धन्ध्यता निवारण ज्वर पथरी आदि में किया जाता है ।

गेंहू एक पूज्यनीय अनाज है इसकी बालियों व अन्न कणों का उपयोग विभिन्न धार्मिक अनुष्ठानों पूजा व यज्ञ में आहूति देने के लिए किया जाता है ।

मक्का (जीआ मेज)

विभिन्न भाषाओ में नाम बंगाली-भुटटा, गुजराती मकई, हिन्दी मराठी उडिया- मक्का तमिल, मक्का चोलम, तेलगू –भवका । मक्का विश्व की महत्वपूर्ण धान फसलों में से एक है । इसकी उत्पत्ति लगभग 5000 वर्ष पूर्व मेक्सिको, मध्य अथवा दक्षिणी पश्चिमी अमरीका में एक जगली पौधे के रूप में हुई थी

। बाद में उत्परिवर्तन व प्राकृतिक वरण से इसने एक महत्वपूर्ण धान्य फसल का रूप ले लिया । भारत में मक्का की खेती 15वी सदी ई0 में प्रारम्भ होने के प्रमाण मिलते हैं। गेंहू जौ और चावल की खेती भारत में प्राचीन काल से होती रही है। मक्का खरीफ रबी एंव जायद अर्थात तीनों ऋतुओं की फसल है । मक्का के दाने में कार्बोहाइट्रेड 79 प्रतिशत, प्रोटीन 5प्रतिशत, वसा 5 प्रतिशत तथा राख 2 प्रतिशत पायी जाती है। ज्ञातव्य है कि धान्य फसलों के मुकाबले में इसमें स्टार्च की मात्रा सबसे अधिक पाई जाती है ।मक्के में जिन्क प्रोटीन होता है। गेंहू व चावल के समान मक्का भी कई देशों का प्रारम्भिक भोज्य पदार्थ है। इसका ज्यादातर उपयोग चपाती, दलिया व कार्न फलेक्स के रूप में किया जाता है । मक्का से प्राप्त स्टार्च कार्नस्टार्च कहलाता है। जोकि घर में कई स्वादिष्ट व्यंजन बनाने में उपयोग किया जाता है इसमें फ्रक्टोज शर्करी पायी जाती है। फ्रक्टोज शर्करी के किण्वन एवं आसुतीकरण से एल्कोहल बनाया जाता है। जोकि विस्हकी बनाने में उपयोग होता है । कार्नस्टार्च से बीयर भी बनाई जाती है। संयुक्त राज्य अमेरिका तथा कनाडा में मक्का का उपयोग पशुओं के चारे के रूप में किया जाता है। अमेरिका का मुर्गीपालन उद्योग भी मक्का के कणों पर ही आधारित है।

गन्ना (सेकेरम आकीसिनेरम)

विभिन्न भाषाओं में नाम: संस्कृत-काश, सुकाण्ड, काकसु, हिन्दी- कास, गन्ना, तेलगू-रलू, तमिल-पोवन, करम्बू, कन्नड- पाटापारी, काबू, मलयालम-करिमबू।

गन्ने की खेती सर्वप्रथम - न्यूगिनी में लगभग 8000 वर्ष पूर्व से की जा रही है। भारत में गन्ने की खेती लगभग 2000 वर्ष पूर्व से की जाने लगी। भारत में 1827 ईसवी में मारिशस से सेकेरम आफीसिनेरम नामक प्रजाति लायी गयी थी । इस प्रजाति मेंमें सुक्रोज नामक शर्करा अधिक एवं रेशे कम होते हैं।

गन्ने के प्रति 100 ग्राम तने के टुकडों में जो 62 केलोरी

उर्जा होती है जिसमें प्रोटीन 0.6 ग्राम, वसा 0.1 ग्राम, कार्बोहाइट्रेड 16.5 ग्राम, जल 82.5 ग्राम तथा रेशे 3.1 ग्राम होते हैं। इसके अलावा इसमें केल्शियम, फासफोरस, लोहा जैसे खनिज एवं केरोटीन, थायमीन, राइबो फलैविन, नियासिन तथा एस्कार्बिक अम्ल उपस्थित होते हैं। गन्ना विश्व में शर्करा का मुख्य स्त्रोत है प्राचीन काल से ही गन्ना इसके मीठे रस केलिए चूसा जाता था। गन्ने से केन शर्करा, केन शर्बत, शीरा मोम एवं रम प्राप्त होती है । शीरे का उपयोग मिठास देने के लिए औद्योगिक एल्कोहल,विस्फोटक पदार्थ बनाने में और कृत्रिम रबर निर्माण आदि में किया जाता है। गन्ने से प्राप्त शर्करा का उपयोग फल

तथा मांस को सुरक्षित करने में किया जाता है । अपरिपक्व पुष्पक्रम को कच्चा या पकाकर खाने के काम में लाया जाता है । गन्ने की खोई तथा शीरे को पालतू जानवरों के चारे के लिए एक उत्तम विकल्प माना जाता है । गन्ने की खोई का उपयोग कागज, कार्डबोर्ड बनाने एवं ईंधन के रूप में किया जाता है । रीड का उपयोग पेन, मेट बनाने में किया जाता है । गन्ना पित्त, दाह, मूत्रकृच्छ क्षय, पथरी, रूधिर विकार रक्तपित्त सतशय और पित्त के रोगों में लाभकारी बताया गया है । पारम्परिक औषधि में गन्ने का उपयोग केंसर, रोग प्रतिरोधक क्षमता बढाने में विषनाशक, प्रतिरोधी, जीवायूनाशक हदय को ताकत देने तथा शीतलता प्रदान करने के लिए किया जाता है । इसके रस का उपयोग गुड बनाने में किया जाता है । गुड का उपयोग रक्तशोधन एवं कडवी दवाईयों स्वादिष्ट बनाने में किया जाता है ।

गन्ना एक पवित्र पौधा है । इसका उपयोग कई धार्मिक अनुष्ठानों में किया जाता है । गन्ने की पूजा आदिवासियों द्वारा दिवाली के दूसरे दिन गोवर्धन पूजा मे की जाती है । गन्ने की पत्ती के तीखे किनारों का उपयोग त्वचा पर चित्तियां एवं गोदने बनाने में किया जाता है ।

बांस (डेन्ड्रेलेमस स्ट्रिक्टस)

विभिन्न भाषाओं में नामः नर बांस, बांस

बांस की उत्पत्ति स्थल चीन है बांस के लगभग 10 वंश एवं 1450 बांस प्रजातियां पूरे विश्व में पायी जाती है । बांस विश्व के सबसे तेज वृद्धि करने वाले पौधों में से एक है । इसकी वृद्धि दर 100 सेमी,प्रतिदिन भी देखी गयी है । साधारणतया इसकी वृद्धि 3-10 सेमी प्रतिदिन होती है । एशियाई देशों मे बांस की आर्थिक तथा पारिस्थितिक महत्ता बहुत अधिक है । यह प्रमुख निर्माण पदार्थ के रूप में जाना जाता है ।

बांस की कोमल और तरूण प्ररोह का उपयोग सब्जी व अचार बनाने में किया जाता है । बांस के बीच जो अकाल के साथ जोडा जाता है जिस वर्ष इसमें फल तथ बीज बनते है उस वर्ष ऐसा माना जाता है कि अकाल पडेगा । अतः बीजों का संग्रहण किया जाता है । एवं अकाल के समय इन्हें चावल की तरह उबालकर खाया जाता है । बांस के खोखले तने में चावल भरकर पकाया जाता है इसके बीज से खीर भी बनाई जाती है । बांस की पत्तियों का उपयोग हाथी व घोडे के चारे के रूप में किया जाता है । नेपाल के लालपाण्डा एवं मेडागास्कर के बेम्बू लीमर का यह मुख्य भोजन है ।

बांस के पल्प पर पाए जाने वाले शलभ व इनका

लार्वा चीन म्यांमार तथा थाईलेण्ड आदि देशों में बडे चाव से खाया जाता है।

बांस से तैयार किया गया बहुपयोगी सामान

बांस का उपयोग घर तथा घर के लिए फर्नीचर, फर्श, केबिनेट और सजावटी समान आदि बनाने में किया जाता है वहीं इसका उपयोग कृषि उपयोगी उपकरण टोकरियां, खेतो तथ झोपडियां के चारो ओर बाड

बनाने में वृक्षो की सुरक्षा हेतु ट्री गार्ड मचान एवं खेतों में कृतनाक नियंत्रण हेतु तथा उल्लूमों के बैठने के डण्डे आदि बनाने में किया जाता है। बांस से कई तरह के

वाद्य उपकरण जैसे- बांसुरी, ड्म्र, क्लेपर तथा जल तरंग आदि भी बनाए जाते हैं। बांस का उपयोग बांध, पानी भरने की टंकी, छन्नी, सीडियां बेलगाडी, मछली पकडने की जड, तम्बू, खटिया, छडी, छाता, हुक्का पाइप तथा कंघी इत्यादि तरह की सामग्री बनाने में किया जाता है। बांस से औजार जैसे तीर कमान, लठ्ठ तथा डण्डे आदि भी बनाए जाते हैं।

बांस का उपयोग औषधि के रूप में भी प्राचीन काल से किया जा रहा है।बांस के तने में पाया जाने वाला सिलिका युक्त पदार्थ बांस लोचन का उपयोग आयुर्वेद में श्वसन तंत्र से सम्बन्धित रोगों को दूर करने में किया जाता है। बांस की पत्तियों के रस का उपयोग मधुमेह में रूधिर से शकर्रा कम करने के लिए किया जाता है। बांस पर पाए जाने वाले काले पदार्थ में चूना मिलाकर लगाने से घाव व फोडे फुन्सियां ठीक हो जाते हैं। बांस का उपयोग पशुओं की बीमारियां दूर करने में भी किया जाता है। इसके तने का रस प्राणियों की टूटी हडिडयों को जोडने के लिए दिया जाता है। साथ ही बांस को जानवरों की टूटी टांग से बांध दिया जाता है ताकि टूटी टांग को सहारा मिल सके एवं वे फिर से चल फिर सके। इसकी तरूण प्ररोह को जानवरों को खिलाने से उनके पेट की कीडे मर जाते हें। बांस लोचन का उपयोग जानवरों को ताकत लाने में किया जाता है। बांस से सेल्यूलोज की मात्रा अधिक होने से कागज भी बनाया जाता है। कागज बनाने में मुख्यतः बांस की दो प्रजातियां बेम्बूसा ब्लूमियेना तथ डेन्ड्रेलेमस एस्पर की खेती भी की जाती है। बांस के रेशे छोटे होते हैं। अतः इसके साथ रेशे मिलाकर

कपडा भी बनाया जाता है जिसकी सोखने की क्षमता अधिक होती है एवं कपडा मुलायम होता है। बांस पर आधारित कई औद्योगिक एवं लघु इकाइयां है जोकि प्रतिवर्ष लगभग 25 बिलियन डालर का कारोबार करती है।

जौ (हार्डियम वल्गेर)

विभिन्न भाषाओं में नाम : हिन्दी जौ, तमिल बार्ली, अरीसी, मलयालम थावम, तेलगू बार्लीए बीयाम, गुजराती जब, बंगाली जवु, मराठी जव जौ का उदभव लगभग 5000-10000 ईसा पूर्व में दो केन्दों एबीसिनीया. इथोपिया व दक्षिण एशिया में हुआ था। जो उत्तरी गोलार्द्ध के शीतोष्ण क्षेत्रों की मुख्य फसल है । भारतवर्ष से यह मुख्यतः उत्तरी क्षेत्रों में उगाया

जाता है। जौ के प्रति 100ग्राम दानों से लगभग 352 केलोरी उर्जा प्राप्त होती है। जौ कि100 ग्राम कण में प्रोटीन 10 ग्राम, कार्बोहाइड्रेट 72.5 ग्राम, रेशे 15.5 ग्राम, शकर्रा 0.89 ग्राम, वसा 1.15 ग्राम राख 1.1 ग्राम खनिज केल्शियम लोहा आयरन, मेग्नीशियम एवं विटामिन्स ए, ई तथा के पाए जाते हैं। जौ के आटे की चपाती व दलिया बनाया जाता है। उत्तर प्रदेश तथा बिहार में इसे सत्तू एक ठण्डा पेय के रूप में प्रयोग किया जाता है । चूंकि इसके आटे में रेशे की मात्रा अधिक होती है। अतः रोगियों के लिए इसकी रोटी लाभप्रद होती है । अनेक पश्चिमी देशों में जौ को पशुओं व कुक्कुट आहार के रूप में प्रयोग किया जाता है । उत्तरी अमेरिका में कुल जौ उत्पादन का आधा भाग पशुओं के चारे के रूप में उपयोग किया जाता है जौ का उपयोग माल्ट उत्पादों के निर्माण में किया जाता है । इसके लिए जौ के बीजों को अंकुरित कराकर कम तापमान पर रखा जाता है अंकुरित बीजों में अनेक एन्जाइम प्रक्रियाए प्रारम्भ हो जाती है जिनके फलस्वरूप अन्नकणो में उपस्थित स्टार्च शकर्रा में परिवर्तित हो जाती हैं इस प्रकार माल्टीकृत जौ व मल्टीकृत गेंहू को 2:1 अनुपात में मिलाकर घोल तैयार कर लिया जाता है । इस घोल का उपकेन्द्रण कर इसमें उपस्थित ठोस पदार्थो को अलग कर लिया जाता है। तत्पश्चात घोल को संतृप्त कर लिया जाता है । यह माल्ट निष्कर्ष कहलाता है । माल्ट निष्कर्ष से माल्ट शकर्रा माल्ट एन्जाइम, माल्ट आटा आदि बनाया जाता है । अनेक मद्य निर्माण शालाओं में माल्ट से बीयर तथा वाइन बनायी जाती है माल्ट से

कई प्रकार के आसुत पेय पदार्थ बनाए जाते हैं जैसे बार्ले पानी व बार्ले चाय। इनका सेवन पाचन क्रिया में सहायता प्रदान करता है कई देशों में इसके बीजों को काफी के विकल्प की तरह उपयोग किया जाता है।

आयुर्वेद के अनुसार यह कफ निकालने वाला पोष्टिक शीतलता प्रदान करने वाला पेट को मुलायम करने वाला और स्निग्ध है। और यह मूत्रवर्धक रक्त में शकर्रा कम करने वाला कामोत्तेजक एवं शामक पदार्थ है। आयुर्वेद में इसकी जडों के किण्वन से बनाए गए रस का उपयोग मधुमेह में किया जाता है पूरे जौ या इसके बीजो का काडा बनाकर पथरी हृदय रोग रक्तचाप रक्त की कमी बुखार सर्दी और खांसी आदि रोगों के उपचार हेतु उपयोग में लाया जाता है। जौ की भूसी में एंटीटयूमरस, एंटी प्रोटोजोअल एवं एंटी वायरल तत्व भी पाए जाते है। जौ के बीजों का तालाब में डाल दिया जाता है जोकि पानी में पाए जाने वाले जीवों को नुकसान पहुंचाए बिना अनावश्यक शेवाल की वृद्धि को रोकते हैं।

ज्वार से बनाई गई रोटी

ज्वार (सोरधम वल्गेर)

विभिन्न भाषाओं में नाम हिन्दी- ज्वार, संस्कृत-जुरना, तेलगू -जोनालु -कन्नड. जोला तमिल.- चोलम उडिया -जनाहा

ज्वार कम वर्षा वाले शुष्क क्षेत्रों की एक महत्वपूर्ण फसल है इसकी उत्पत्ति का केन्द्र अफ्रीका है। ज्वर की

खेती अफ्रीका अमेरिका, भारत, चीन, पाकिस्तान और अरब आदि अनेक देशों में रबी तथा खरीफ दोनों

फसलों के रूप में की जाती है। भारत में इसका उत्पादन महाराष्ट्र, कर्नाटक, आन्ध्रप्रदेश, गुजरात, राजस्थान, उत्तर प्रदेश व तमिलनाडू आदि राज्यों में किया जाता है। ज्वार के 100 ग्राम दानों से 329 केलोरी उर्जा प्राप्त होती है। ज्वार के 100 ग्राम दानों में प्रोटीन वसा, कार्बोहाइड्रेट रेशे तथा केल्शीयम, फास्फोरस, नामक खनिज एवं थायमीन, नियासिन और राइबो फलोविन पाए जाते हैं।

ज्वार के अन्न कण पोषक व बल बर्धक होते हैं इन्हें चपाती, दलिया, अथवा मिठाई आदि अनेक रूपों में प्रयुक्त किया जाता है। यह निर्धन का मुख्य आहार है। इनके बीजो को अंकुरित करके माल्ट भी बनायाजाता है जिसका उपयोग एल्कोहालिक पेयपदार्थ बनाने में किया जाता है यह एक उत्तम पशु आहार है। इसके अन्न कण पालतू पशु जैसे- गाय, भैंस, बैल, घोडे व मुर्गियों के आहार में प्रयुक्त किए जाते हैं। इसकी अनेक किस्में चारे के लिए विकसित की गयी है। आयुर्वेद में ज्वार के कण स्वभाव में मीठा, कफ निकालने वाला, पौष्टिक, ठण्डा, रूधिर का थक्का बनानेवाला, स्नेहक, पेचिश रोकने वाला तथा वीर्य को बढाने वाला होता है। अतः इस अनाज का उपयोग विभिन्न व्याधियों जैसे कफ, अस्थमा, बुखार, फेफडों से सम्बन्धित रोग, पेचिश, अल्सर, एनीमिया, तथा सिरदर्द आदि के उपचार में किया जाता है। ज्वार क मूण्डको को निकालने के बाद बचे भाग से झाडू बनाई जाती है। *पाल्ज व चारटियर 1980* के अनुसार ज्वार की बची हुई भूसी से औसतन 15 मेगाजूल किग्रा उर्जा का उत्पादन किया जाता है। अतः इस फसल का हर भाग मानव जीवन के लिए उपयोगी है।

Know Your Biodiversity

Dr. Swaran Lata and Preeti Kaushal
Himalayan Forest Research Institute (HFRI)
(Indian Council of Forestry Research & Education, Ministry of Environment, Forests and Climate Change, Govt. of India)
Shimla (Himachal Pradesh)

***Oriolus oriolus* L.**

Oriolus oriolus also known as Eurasian Golden Oriole, Golden Oriole, or Swaran Peelak is about the size of Myna approximately 25 cm in size. It belongs to order Passeriformes and family Oriolidae. The Golden Oriole is found throughout Europe and western Asia but also in few parts of Africa. Generally ranges eastward to Central Asia and India. *Oriolus oriolus* is distributed in all India from Kashmir in the Himalayas down to Kanyakumari and from Gujarat to Bengal. The bird is the resident in many localities and local migrant in others. In summers birds may visit to the Himalayan foothills to about 2600 m, spreads in winters to plains. It breeds also in many parts of peninsular India.

The bird has bright golden with black in the wings and tail and a conspicuous black streak through the eye. Popularly known as Mango Bird, is a dweller of open, but well-wooded country and is particularly fond of orchards and groves of large leafy trees such as chinar, mango, sisham and toon.

Males have largely black wings with smaller yellow carpal patch and only indistinct whitish tips, two-thirds black on outer tail feather, and black mask does not extend behind eye. They have bright golden yellow plumage, black stripe through eye, black wings and centre of tail. Whereas young males much alike females. They have less yellow on outer tail feathers and often greyer or more olive and less heavily streaked on under parts. They are yellow-green above, brownish green wings, dirty white below, and streaked brown. *Oriolus oriolus* is commonly seen as solitary or in pairs, arboreal, regularly visits fruiting and flowering trees, hunts insects in leafy branches. Bills are shorter, less down curved and darker red in adult. They are generally non- social arboreal birds and usually make deciduous semi-evergreen forests as their natural habitats but can often be found in groves of large trees close to habitations, as well as in gardens and on the side of busy, noisy roads. Though it is a bird that keeps to the trees and frequent countryside that is well-wooded yet open. The flight of the bird is strong yet dipping. For eating bird depends on insects, figs as well as other fruits, berries and the nectar of flowers. Voice of *Oriolus oriolus* is fluty whistle of two or three notes, interpretated pee.lo.lo, the middle note is lower and harsh note often heard. They sing a rich mellow song when breding, somewhat mournful, though they doesn't sing often.

The season over the greater part of its range is from April to July. The nest is a beautifully woven, deep-cut of bast fibers. A good deal of cow webs is used to bind

the material together. It is suspended like a hammock in a horizontal fork of twigs near the end of an out hanging branch of some large leafy tree, 12 to 30 feet from the ground. Female, lays between 2 and 5 eggs which hatch after an incubation period of between 15 to 20 days that is predominantly conducted by female. Once hatched, both Golden Oriole parents help to feed and look after their young ones, which will have their nest within 20 days. Orioles usually live to be around 7 or 10 years old. The eggs are white, spotted with black and reddish-brown in color. Both sexes share in building the nest, incubation, and tending the young.

Conservational status- Schedule- IV, according to wildlife (Protection) act, 1972 and classified as Least Concern (LC) by IUCN. However, due to over- exploitation of natural habitations, every single species is getting hazardous affect and thus we need to take care of these species before they come under threatened categories.

***Melia azedarach* L.**

Melia azedarach belongs from Order Sapindales and Family Meliaceae commonly known by many names, including Persian Lilac, Indian Lilac, Chinaberry, Bead Tree, and Bastard Tree and in Hindi known as Bakain, Drek and Deikna.

There is little agreement about its natural range. Wild specimens are reported from Baluchistan and less certainly, from Shivaliks. Some regards the tree as West Asian, others as purely South Asian and yet others as being widely distributed **in** Indo-Malaya, Persia, China and Iran. In India commonly seen in NW Himalaya, Jhelum valley. *Melia azedarach* is often planted in villages and along roadsides in the Himalaya.

Bakain is hardy and adaptable and does best on deep, sandy loams in dry, open habitats. It withstands frost and is reasonably drought-hardy but can be somewhat invasive, regenerative without assistance along road sides and is distributed in land. It grows rapidly at first, but lives only for 20 years or so.

It is a long-limbed tree with a dense, spreading crown, superficially resembling the neem. Bakain is quick growing but short-lived and is prized above all for its talcum-scented white and lilac flowers in spring. The neem, which it resembles in general way. The key difference is that neem leaves are feather-compound, i.e. only once divided, while those of bakain are mostly twice divided (2-pinnate) but often also 3-pinnate near the base. Another difference is that neem flowers are purely white, with none of the lilac or purple that is seen in *Melia azedarach*.

It is a middle-sized deciduous tree, 4-10 m tall approximately. Bark is dark grey, grey, greyish-brown or vertically fissured, fissures shallow. Young shoots and inflorescence sparsely clothed with deciduous stellate hairs. Leaves are usually bipinnate, occasionally tripinnate, opposite, or nearly so, 3-4 pairs, 20-45 cm long. Whereas leaflets are 3-12 in number, ovate-lanceolate, long pointed, acuminate,

bluntly serrate, sometimes lobed, glabrous, unequally sided, elliptic or ovate-oblong. Flowers are lilac, sweet-scented, 0.6-0.9 cm long, long-stalked in axillary clusters. Calyx is deeply 5-6 lobed, hairy outside, acute, unequal, ovate-oblong, linear, obtuse, and pubescent. Petals are 5-6, lilac blue, 1 cm long, linear-lanceolate, much exceeding the calyx, free, minutely pubescent. Staminal tube is purple, conspicuous, 20 toothed, faintly ribbed outside, apex dilated and toothed, hairy within; anthers 6-12, sessile. Ovary is around 2 mm long, usually 5-celled; style 4-5 m long, much exceeding the ovary; stigma capital. Fruit are Drupes, ovoid or globose, 1.3-2 cm in diameter, yellow and wrinkled when ripe and remain on tree long after the leaves have fallen. Flowering and Fruiting season if from March to August.

Many parts of the tree, especially the fruit, are dangerously narcotic, except perhaps to birds (bulbul seems to be immune).Wood is used for toys, cigar and ammunition boxes and other packing and museum cases, also suitable for agricultural implements, turnery, musical instruments and ornamental plywood. Decoction of bark expels worms from body. Leaf juice is anthelmintic and diuretic. Leaves are also lopped for fodder. Decoction of the leaves is regarded as astringent and stomachic, and used for skin eruption. A gum collected from the tree used in spleen enlargement and infusion of bark is used in ascariasis. Fruit is used as beads for necklaces and rosaries; worn as a charm against disease. The fruit and leaves are applied as poultice to relieve nervous headaches. The leaves, fruits and bark are useful in leprosy. The seeds are used in rheumatism. Seeds also yield a drying oil suitable for soap making and hair oils.

Due to short live span of this tree and over-exploitation because of its multiple uses this plant species is already rare in number. Ecological monitoring is one of the essential strategies required for the conservation and thus proper steps should be taken for the conservation of *Melia azedarach*.

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P.O. RFRC, Mandla Road
Jabalpur – 482021 M.P. India
Phone: 91-761-2840484
Fax: 91-761-2840484
E-mail: vansangyan_tfri@icfre.org
Visit us at: http://tfri.icfre.org or http://tfri.icfre.gov.in